VOL. 7 NO. 1
January 15, 1982

# Energy Research Abstracts

ABSTRACTS 1-1715

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

# CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

## PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

***Energy Abstracts for Policy Analysis (EAPA)***

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $4.50, foreign $5.65 per copy; annual cumulative index, domestic $7.00, foreign $8.75 per copy. The annual subscription price is $48.00 for domestic subscribers and $60.00 for foreign subscribers.

***Energy Research Abstracts (ERA)***

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic subscribers and $150.00 for subscribers outside the North American Continent, except as listed below for *DOE Patents Available for Licensing (PAL)*. A single issue is $7.00 (domestic) and $14.00 (outside the North American Continent).

***Current Energy Patents (CEP)***

A monthly publication providing abstracting and indexing coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization. Available as PB82-902800.

***DOE Patents Available for Licensing (PAL)***

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage to this literature. Available as PB82-946800; the annual subscription price is $14.00 (domestic) and $28.00 (foreign).

***Energy and the Environment (EAE)***

A monthly abstract journal devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment. Available as PB82-914900.

***Fossil Energy Update (FEU)***

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB82-914600.

***Fusion Energy Update (CFU)***

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB82-915300.

***Geothermal Energy Update (GEU)***

A monthly abstract journal devoted to information on the exploration and development of geothermal resources. Available as PB82-914700.

***Solar Energy Update (SEU)***

A monthly abstract journal devoted to information on the utilization of solar energy, including biomass and tidal and wind power. Available as PB82-914500.

The following publications are available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual rate for one volume (calendar) year (12 issues) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American Continent.

***Direct Energy Conversion (DEC)***

A semimonthly current awareness bulletin covering the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells. Available as PB82-946600.

***Nuclear Fuel Cycle (NFC)***

A semimonthly current awareness bulletin covering all aspects of the nuclear fuel cycle, both front end and back end. Available as PB82-813400.

***Nuclear Reactor Safety (NRS)***

A semimonthly current awareness bulletin covering the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures. Available as PB82-913500.

***Radioactive Waste Management (RWM)***

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB82-902900.

## INTERNATIONAL ENERGY PUBLICATIONS

***Atomindex*** (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

***Coal Abstracts*** (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

International Copyright © U. S. Department of Energy, 1979, under the provisions of the Universal Copyright Convention. United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

# ERRATA

| Vol. | Issue | Replace Bibliographic Citation with: |
|---|---|---|
| 6 | 4 | **4956** (P–700-79-016) **California Energy Commission staff paper. Issues related to reliability of power plants in California.** Shurley, L.A. (California Energy Commission, Sacramento (USA)). 1979. 66p. California Energy Commission, Sacramento. |
| 6 | 5 | **6043** (INT-FES–80-48) **Proposed Four Corners-Ambrosia-Pajarito 500 kV transmission project. Final environmental statement.** (Bureau of Indian Affairs. Washington, DC (USA)). 1980. 333p. Bureau of Indian Affairs, Washington, DC. |
| 6 | 7 | **8620** (UCRL–84084(Rev.2)) **Possible mechanism of alkene/alkane production in oil shale retorting.** Burnham, A.K.; Ward, R.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 26 Nov 1980. Contract W-7405-ENG-48. 20p. (CONF-800889–1(Rev.1)). NTIS, PC A02/MF A01. |
| 6 | 14 | **19758** (DOE/ER/10683–2) **Microbiological aspects of oil production.** Finnerty, W.R. (Georgia Univ., Athens (USA)). 1981. Contract AS09-80ER10683. 18p. NTIS, PC A02/MF A01. |
| 6 | 17 | **26608** (BNL–29332) **Neutron scattering measurements of low-temperature hydrogen tunneling in niobium.** Wipf, H.; Magerl, A.; Shapiro, S.M.; Satija, S.K.; Thomlinson, W. (Brookhaven National Lab., Upton, NY (USA); National Bureau of Standards, Washington, DC (USA); Muenchen Univ. (Germany, F.R.)). 1981. Contract AC02-76CH00016. 9p. (CONF-810497–2). NTIS, PC A02/MF A01. Order Number DE81025095. |
| 6 | 19 | **28197** (K/ET–5014(Rev.2)) **Portable transfer standards for pressure and gas flow measurements.** Fain, D.E.; Selby, T.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jan 1981. Contract W-7405-ENG-26. 27p. (CONF-810434–6(Rev.2)). NTIS, PC A03/MF A01. Order Number DE81024445. |
| 6 | 19 | **28787** (DOE/S–0014) **Securing America's energy future: the national energy policy plan.** (Department of Energy, Washington, DC (USA)). Jul 1981. 37p. NTIS, PC A03/MF A01. Order Number DE81026612. |
| 6 | 19 | **29161** (DOE/SF/01123–T58) **Brayton isotope power system. Phase I. Ground demonstration system, configuration control document (CCD).** (AiResearch Mfg. Co., Phoenix, AZ (USA)). 14 Dec 1976. Contract AC03-76SF01123. 339p. NTIS, PC A15/MF A01. |

energinfo ERA

Vol. 7, No. 1
ISSN: 0160-3604
CODEN: ERABD
January 15, 1982

# ENERGY RESEARCH ABSTRACTS

## ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to catalog official DOE issue-and-policy documents, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

UNITED STATES DEPARTMENT OF ENERGY

**James B. Edwards**
Secretary

**William S. Heffelfinger**
Assistant Secretary
Management and Administration

**Joseph G. Coyne**
Manager
Technical Information Center

## ABOUT *ENERGY RESEARCH ABSTRACTS*

*Energy Research Abstracts (ERA)* provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

*ERA* is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

*ERA* is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

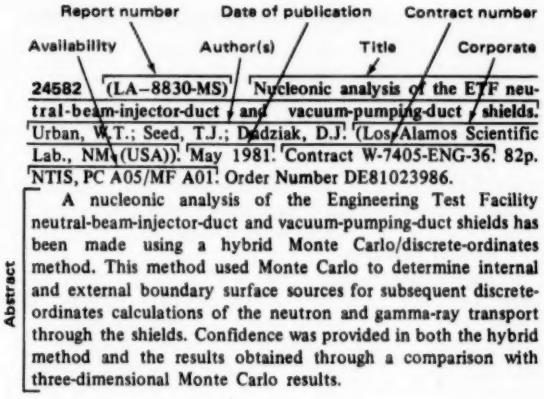
*ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign). The cumulative indexes will be available in microfiche form only. The microfiche may be purchased from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37830.

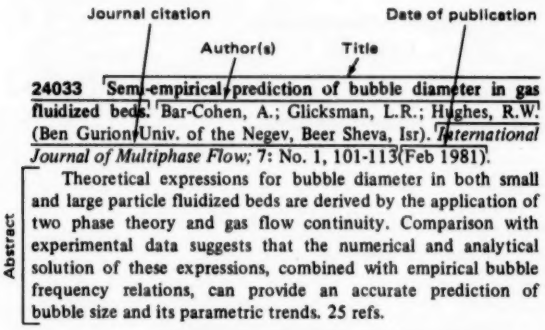
Published by the **United States Department of Energy, Technical Information Center**
**P. O. Box 62, Oak Ridge, Tennessee 37830**

# HOW TO USE *ENERGY RESEARCH ABSTRACTS*

## • ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Contract number
Availability
Author(s)
Title
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.
Abstract
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Abstract
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

## • INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

### • Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

**Los Alamos Scientific Lab., NM (USA)**
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

### • Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

**Bar-Cohen, A.,** Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033
**Dudziak, D.J.,** *See* Urban, W.T., 6:24582
**Glicksman, L.R.,** *See* Bar-Cohen, A., 7:24033
**Hughes, R.W.,** *See* Bar-Cohen, A., 7:24033
**Seed, T.J.,** *See* Urban, W.T., 6:24582
**Urban, W.T.,** Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

### • Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles or informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

**TOKAMAK ETF**
**Neutral Atom Beam Injection**
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)
**Neutron Transport**
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

### • Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

| | | |
|---|---|---|
| **W-7405-ENG-36** | **Los Alamos National Lab., NM (USA)** | |
| | 6:24582 | LA–8830-MS |

### • Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number-Report Number Correlation is included for convenience.

| | | |
|---|---|---|
| **LA–** | | |
| **8830-MS** | **6:24582** | **NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d** |

# STAFF OF ENERGY RESEARCH ABSTRACTS

**Editor**
David E. Bost

**Assistant Editors**
Lee M. Thompson
Charles E. Stuber

**Associate Editors for Fossil Energy**
M. Catherine Grissom
D. Lamar Cason
Dorothy M. Chertok
Lynda H. Kern
Betty L. McDowell
Lorne T. Newman
Donna G. Powers
Amy T. Tamura

**Associate Editors for Physical Sciences and Engineering**
Robert C. Kelly
Jack Blanshei
Donato DiGregorio
Lisbeth C. Lieberman
W. Hugh Kinser
George H. Thoeming

**Associate Editors for Environmental, Biomedical, and Life Sciences**
Sidney F. Lanier
E. Ray Bedford
Polly S. Blackburn
Jane G. Buchanan
Robert J. Chertok
Kathleen R. Meyer
Axel C. Ringe
David L. Snow

**Associate Editors for Nuclear Energy**
Henry D. Raleigh
David C. Cunningham
James R. Dulaney
Lawrence T. Whitehead
Milton O. Whitson

**Associate Editors for Conservation and Solar Energy**
Lila B. Smith
Dona C. Keller
Mona H. Raridon
Jerry M. Thomas
Martha C. Wilson
Larry E. Williams

**Report Evaluator**
John H. Mitchell

**Subject Heading Specialist**
Julia S. Redford

**Corporate Author Specialist**
Patsy L. Hendricks

**Report Number Specialist**
Wanda Parks

**Contract Number Specialist**
William D. Matheny

**Cataloging and Digitizing Coordinator**
J. Paul Meredith

**Computer Processing Coordinator**
Billy H. Brady

**Publishing Coordinator**
Irene D. Keller

International Copyright, © U. S. Department of Energy, 1979, under the provisions of the Universal Copyright Convention. United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts*, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

# SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

**01 COAL AND COAL PRODUCTS**
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Regulations

**02 PETROLEUM**
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

**03 NATURAL GAS**
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Effects
- 09 Artificial Stimulation, Plowshare, etc.
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

**04 OIL SHALES AND TAR SANDS**
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

**05 NUCLEAR FUELS**
- 01 Reserves
- 02 Exploration
- 03 Mining
- 04 Feed Processing
- 05 Enrichment
- 06 By-Products
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing and Economics
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Regulations

**06 FUSION FUELS**
- 01 Sources
- 02 Processing
- 03 By-Products
- 04 Transport and Storage
- 05 Health and Safety
- 06 Regulations and Policy
- 07 Waste Management
- 08 Properties
- 09 Environmental Aspects

**07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY**
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies

**08 HYDROGEN**
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

**09 OTHER SYNTHETIC AND NATURAL FUELS**
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

**13 HYDRO ENERGY**
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power Conversion Systems

**14 SOLAR ENERGY**
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Plants
- 07 Solar Thermal Power Plants
- 08 Ocean Thermal Gradient Power Plants
- 09 Solar Radiation Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

**15 GEOTHERMAL ENERGY**
- 01 Resource Status and Assessment
- 02 Geology, Hydrology, and Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

**15 GEOTHERMAL ENERGY (CONT.)**
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

**16 TIDAL POWER**
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

**17 WIND ENERGY**
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

**20 ELECTRIC POWER ENGINEERING**
- 01 Power Plants and Power Generation
- 02 Environmental Aspects
- 03 Power Transmission and Distribution

**21 NUCLEAR POWER PLANTS**
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics
- 09 Process Heat Reactors

**22 NUCLEAR REACTOR TECHNOLOGY**
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

**25 ENERGY STORAGE**
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

**29 ENERGY PLANNING AND POLICY**
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

**30 ENERGY CONVERSION**
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Electromechanical Converters

**32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION**
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

**33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS**
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

**36 MATERIALS**
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 04 Polymers and Plastics
- 06 Other Materials

**40 CHEMISTRY**
- 01 Analytical and Separations Chemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion Chemistry

**42 ENGINEERING**
- 01 General Engineering
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing

**42 ENGINEERING (CONT.)**
- 06 Safety Engineering
- 07 Vacuum Engineering
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

**43 PARTICLE ACCELERATORS**
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

**44 INSTRUMENTATION**
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

**45 EXPLOSIONS AND EXPLOSIVES**
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

**50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**51 ENVIRONMENTAL SCIENCES, TERRESTRIAL**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**52 ENVIRONMENTAL SCIENCES, AQUATIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES**
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements

**55 BIOMEDICAL SCIENCES, BASIC STUDIES**
01 Behavioral Biology
02 Biochemistry
03 Cytology
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

**56 BIOMEDICAL SCIENCES, APPLIED STUDIES**
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicity
04 Other Environmental Pollutant Effects

**57 HEALTH AND SAFETY**

**58 GEOSCIENCES**
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

**64 PHYSICS RESEARCH**
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

**65 PHYSICS RESEARCH (CONT.)**
10 Nuclear Physics
40 Radiation and Shielding Physics
50 Medical Physics
60 Solid State Physics
70 Theoretical Physics
80 Mathematical Physics

**65 PHYSICS RESEARCH (CONT.)**
90 Communication, Education, History, and Philosophy

**70 FUSION ENERGY**
01 Plasma Research
02 Fusion Power Plant Technology

**99 GENERAL AND MISCELLANEOUS**
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

**CORPORATE AUTHOR INDEX**

**PERSONAL AUTHOR INDEX**

**SUBJECT INDEX**

**CONTRACT NUMBER INDEX**

**REPORT NUMBER INDEX**

# SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.


**33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS**
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

**56 BIOMEDICAL SCIENCES, APPLIED STUDIES**
- 03 Chemicals Metabolism and Toxicity
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

**55 BIOMEDICAL SCIENCES, BASIC STUDIES**
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

**40 CHEMISTRY**
- 01 Analytical and Separations Chemistry
- 08 Combustion Chemistry
- 04 Electrochemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

**01 COAL AND COAL PRODUCTS**
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 50 Marketing and Economics
- 20 Mining
- 04 Processing
- 06 Properties
- 70 Regulations
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

**20 ELECTRIC POWER ENGINEERING**
- 02 Environmental Aspects
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

**32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION**
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

**30 ENERGY CONVERSION**
- 02 EHD Generators
- 08 Electromechanical Converters
- 05 Fuel Cells
- 01 MHD Generators
- 04 Thermionic Converters
- 03 Thermoelectric Generators

**29 ENERGY PLANNING AND POLICY**
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

**25 ENERGY STORAGE**
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

**42 ENGINEERING**
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 01 General Engineering
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 06 Safety Engineering
- 20 Underground Engineering
- 07 Vacuum Engineering
- 09 Waste Processing Plants and Equipment

**52 ENVIRONMENTAL SCIENCES, AQUATIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**51 ENVIRONMENTAL SCIENCES, TERRESTRIAL**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES**
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements
- 01 Social and Economic Studies

**45 EXPLOSIONS AND EXPLOSIVES**
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

**70 FUSION ENERGY**
- 02 Fusion Power Plant Technology
- 01 Plasma Research

**06 FUSION FUELS**
- 03 By-Products
- 09 Environmental Aspects
- 05 Health and Safety
- 02 Processing
- 08 Properties
- 06 Regulations and Policy
- 01 Sources
- 04 Transport and Storage
- 07 Waste Management

**99 GENERAL AND MISCELLANEOUS**
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

**58 GEOSCIENCES**
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

**15 GEOTHERMAL ENERGY**
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology, Hydrology, and Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

**57 HEALTH AND SAFETY**

**13 HYDRO ENERGY**
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

**08 HYDROGEN**
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

**44 INSTRUMENTATION**
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

**07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY**
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

**36 MATERIALS**
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 01 Metals and Alloys
- 06 Other Materials
- 04 Polymers and Plastics

**03 NATURAL GAS**
- 09 Artificial Stimulation, Plowshare, etc.
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Effects
- 02 Geology and Exploration
- 05 Health and Safety
- 06 Marketing and Economics
- 10 Policy, Legislation, and Regulation
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

**05 NUCLEAR FUELS**
- 06 By-Products
- 05 Enrichment
- 30 Environmental Aspects
- 02 Exploration
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 10 Marketing and Economics
- 03 Mining
- 50 Regulations
- 01 Reserves
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 20 Waste Management

**21 NUCLEAR POWER PLANTS**
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 09 Process Heat Reactors
- 07 Regulation and Licensing

**22 NUCLEAR REACTOR TECHNOLOGY**
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

**04 OIL SHALES AND TAR SANDS**
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

**09 OTHER SYNTHETIC AND NATURAL FUELS**
02 Alcohol Fuels
06 Gaseous Waste Fuels
01 Hydrocarbon Fuels
03 Inorganic Hydrogen Compound Fuels
05 Liquid Waste Fuels
04 Solid Waste Fuels

**43 PARTICLE ACCELERATORS**
03 Auxiliaries and Components
02 Beam Dynamics, Field Calculations, and Ion Optics
01 Design, Development, and Operation
04 Storage Rings

**02 PETROLEUM**
50 Combustion
03 Drilling and Production
09 Environmental Aspects
02 Geology and Exploration
06 Health and Safety
07 Marketing and Economics
10 Policy, Legislation, and Regulation
04 Processing
05 Products and By-Products
30 Properties
01 Reserves
40 Storage
20 Transport, Pipelines, and Handling
08 Waste Management

**64 PHYSICS RESEARCH**
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

**65 PHYSICS RESEARCH (CONT.)**
90 Communication, Education, History, and Philosophy
80 Mathematical Physics
50 Medical Physics
10 Nuclear Physics
40 Radiation and Shielding Physics
60 Solid State Physics
70 Theoretical Physics

**14 SOLAR ENERGY**
03 Economics
04 Environmental, Legal, and Institutional Aspects
20 Heat Storage
08 Ocean Thermal Gradient Power Plants
06 Photovoltaic Power Plants
01 Resources and Availability
10 Solar Collectors and Concentrators
05 Solar Energy Conversion
09 Solar Radiation Utilization
07 Solar Thermal Power Plants

**16 TIDAL POWER**
04 Economics
05 Environmental Aspects
03 Regulations
07 Tidal Power Plants
08 Wave Energy Converters

**17 WIND ENERGY**
01 Availability (Climatology)
04 Economics
05 Environmental Aspects
03 Regulations
06 Wind Energy Engineering

**CORPORATE AUTHOR INDEX**

**PERSONAL AUTHOR INDEX**

**SUBJECT INDEX**

**CONTRACT NUMBER INDEX**

**REPORT NUMBER INDEX**

# ENERGY RESEARCH ABSTRACTS

## 01 COAL AND COAL PRODUCTS

### 0104 Processing

*REFER ALSO TO CITATION(S) 725*

### 0106 Properties

1 **Mass spectrometric determination of lead isotopes in West German pit coal.** Schladot, J.D.; Hilpert, K.; Nuernberg, H.W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie). pp 325-329 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

The increased lead concentrations in the atmosphere are to be attributed particularly to the combustion of gasoline containing organic lead components as antiknock additives. Furthermore, the operation of smelters and coal burning electric power plants can be important as pollutant sources. Since each natural lead deposit has a characteristic isotopic composition the knowledge of this composition can make it possible to differentiate between the various sources of emission. The isotopes $^{206}Pb$, $^{207}Pb$ and $^{208}Pb$ are continuously created as the end-products of radioactive decay of uranium and thorium. In contrast to that the isotope $^{204}Pb$ is not known to have been formed by any radioactive decay process. The present-day lead isotope ratios are, therefore, a function of the parent uranium-thorium abundances and the age of the systems. In order to identify the lead emitted by coal burning electric power plants the isotopic composition of lead in various West German pit coals was determined by mass spectrometry. The procedure is described, and the results are given and discussed.

### 0108 Waste Management

*REFER ALSO TO CITATION(S) 10, 984, 1005*

### 0109 Environmental Aspects

*REFER ALSO TO CITATION(S) 7, 999*

### 0110 Reserves And Exploration

*REFER ALSO TO CITATION(S) 7*

2 (INIS-mf—6422, pp vp) **Results obtained by efficient nuclear logging methods in brown coal deposit exploration in the North Bohemian Brown Coal Basin.** Cermak, Z.; Koupil, M.; Tulak, P. (Banske Stavby, Most (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

3 (INIS-mf—6422, pp vp) **Practical experience with KR-1010 radiometer in ZUD coal mines at Zbuch.** Pasek, J. (Zapadoceske Uhelne Doly, Zbuch (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

### 0120 Mining

4 **(BCR-L—1245) Mine demonstrations of longwall dust-control techniques. Phase I status report.** Kost, J.A.; du Breuil, F.; Saltsman, R.D. (Bituminous Coal Research, Inc., Monroeville, PA (USA)). 15 Oct 1981. 44p. (USBM-J—0318093). Bituminous Coal Research, Inc., Monroeville, PA. Order Number DE82900425.

The program objective is to evaluate the effectiveness of available dust-control technology for double-drum shearer longwall sections. The primary dust-control techniques to be evaluated are face ventilation, use of water, and coal-cutting sequence. A number of control techniques are to be evaluated on each longwall section to determine their relative effectiveness. The program is divided into three phases: Phase I- Review of Applicable Dust-control Techniques; Phase II - Procurement, Installation, and Modification of Equipment; Phase III - Underground Tests, Evaluation of Results, and Preparation of the Final Report. The Phase I work tasks included: (1) a review of laboratory and underground experiences using techniques to be demonstrated; (2) selection of test sites; and (3) preparation of a test program for demonstrating dust-control techniques. During Phase I, 114 articles, papers, and technical reports were reviewed. A complete bibliography is included as Appendix A. A number of articles were of particular interest and brief summaries were prepared, Appendix B. The summaries include test description, experimental procedure and analysis, and conclusions and results. The selection of test sites began prior to the contract award when BCR was preparing the contract proposal. During Phase I many of these companies were again contacted to determine present mining activities and changes that would affect the test plan submitted as part of the BCR proposal. Four companies, including Bethlehem Steel, Western Slope Carbon, Emery Mining, and Price River Coal Company, are in a position to begin testing before the end of the year.

5 **Evaluation of the microseismic technique for outburst warning at West Cliff Colliery.** McKavanagh, B.M.; Enever, J.R.; Siggins, A.F.; Mackay, J. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1978). 32p. (CSIRO—4).

The microseismic technique was used to monitor a number of outbursts at West Cliff Colliery. Intrinsically safe piezoelectric detectors were installed in-seam near the working face, after testing a variety of mounting methods. Detector signals were analyzed by a single channel count rate monitoring system at a base station situated a safe distance from the face. An approved safety barrier isolated the mains powered base station equipment from the intrinsically safe items. Microseismic signals associated with coal failure were separated from mining noise by an adjustable bandpass filter, counted by a threshold level detector, and charted. Transient waveforms were continuously observed on a digital storage oscilloscope and characteristic waveforms recorded for laboratory analysis. Count rate records were obtained for the microseismic noise preceding two outbursts. These records showed a sustained increase in rate of microseismic activity followed by a fall immediately preceding the outburst. A viable outburst warning system could be developed from the parameters thus established if these prove, by continued monitoring, to be characteristic.

6 **Use of adsorption/desorption isotherms in predicting outburst conditions.** Lama, R.D. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1981). 79p. (CSIRO—21).

These studies indicate that adsorption and desorption isotherms can be used to predict an outburst condition. The P express method and the k' value used overseas do not seem to be valid in-

dexes for predicting an outbursting condition. This could be because of the difference in the physical properties of the coal, but in the absence of more detailed studies, it is difficult to make any definite conclusions on these indices. A new index L has been developed which seems very promising. Further studies are under progress to establish it under a variety of conditions so that this index can be used as a practical means not only of indicating an outburst condition, but also changes in the structural properties of coal, and predicting in advance an approaching shear zone. The L value determination and its usefulness opens up a new field where it would be possible to determine outbursting conditions from existing drill cores obtained during exploration studies or from long drill holes from underground. The index does not require testing on site immediately after extracting a sample. The test is simple, easy to carry out, and the L value for a sample can be calculated in less than 20 minutes. It can easily be adopted as a routine method of predicting outburst conditions in mines.

7 **CSIRO coal research, with emphasis on mining.** Gerrard, C.M. (comp.). Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 51p. (CSIRO—16).

The paper presents a summary of CSIRO coal research projects under the headings of Resource Evaluation, Mining, Beneficiation and Transportation, Utilization and Environmental Aspects. Emphasis in the presentation is given to mining research and coal conversion research is excluded from consideration.

8 **Drainage of methane from the solid at West Cliff Colliery. Part 1. Optimization of drainage hole design parameters.** Lama, R.D. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 79p. (CSIRO—18).

This report presents the results of investigations conducted at West Cliff Colliery on the problem of drainage of gas from the solid using horizontal holes drilled from existing roadways in the Bulli Seam. The results of the investigations include: seam gas content, gas pressure in the Bulli Seam, optimimum spacing of drainage holes; optimum suction pressure to be applied to drainage holes; and stand pipe arrangement. Recommendations are made for a practical methane gas drainage system. These have now been adopted by West Cliff Colliery and a full scale system for drainage of methane from the solid from the Bulli Seam has been established.

9 **Investigation of a bolted coal mine roof during mining at Nattai North Colliery.** Walton, R.J.; Fuller, P.G. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 56p. (CSIRO—24).

The behavior of 1.2 m long resin grouted rock bolts installed in a sandstone roof area of the Nattai North Colliery was studied. Strain gauges were fixed to the bolts to measure the as installed load and the response of the bolts to solids development and pillar extraction close to the test area. The behavior of the roof was also studied by measuring the absolute stress in the roof using the CSIRO hollow inclusion triaxial gauge, the stress changes in the roof using a soft type of stress monitoring gauge and the roof deformation using rod extensometers. The instrumented bolts were bent during installation, probably due to the surface of the roof beneath the collar plate and purlin not being perpendicular to the bolt axis. The magnitude of the combined bending and tensile loads in some cases was enough to cause the steel to yield at and near the bolt surface. Some load loss in the bolts was detected for up to 3 days after bolt installation. The observed behavior of the bolted roof during solids development away from the test site and pillar extraction on the retreat back towards the site is also discussed.

10 **Design of a large field shear box.** Nguyen, V.U.; Ihle, U.W. Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). 10p. (CSIRO—26).

The requirements for a large scale field shear box in studies on slope stability of spoil piles and highwalls in open-cut coal mines are outlined. Design concepts, description and operational procedures of a 1000 x 750 x 672 mm high strength aluminum direct shear box are presented.

11 (INIS-mf—6422, pp vp) **Application of gamma-gamma logging method in the prognosis of anomalous geodynamic effects in hard coal mines.** Blaha, F.; Keclik, L. (Vedeckovyzkumny Uhelny Ustav, Ostrava-Radvanice (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

12 (INIS-mf—6422, pp vp) **Results of a study in stress manifestations in OKR mines by the gamma-gammametric method.** Keclik, L.; Blaha, F. (Vedeckovyzkumny Uhelny Ustav, Ostrava-Radvanice (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

### 0130 Transport And Handling

*REFER ALSO TO CITATION(S) 7*

### 0160 Health And Safety

*REFER ALSO TO CITATION(S) 4, 5, 6, 1196*

## 02 PETROLEUM

### 0202 Geology And Exploration

*REFER ALSO TO CITATION(S) 1249*

13 **Petroleum geology of the continental shelf of northwest Europe.** Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981). 535p. (CONF-8003149—). Heyden and Son Inc., Philadelphia, PA.

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

This proceeding contains the texts of the 46 papers presented at the conference. The topics ranged from regional studies to detailed studies of individual fields, from paleontology to igneous activity. The main headings include: North Sea-regional papers; North Sea-stratigraphic and technological developments; North Sea-selected oil and gas fields; other regions-stratigraphy; and other regions-associated oil and gas fields. Separate abstracts of individual papers have been prepared for inclusion in the Energy Data Base. (DMC)

14 **Evolution of sedimentary basins in northwest Europe.** Ziegler, P.A. (Shell Internationale Petroleum Maatschappij BV, Hague, Netherlands). pp 3-39 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The evolution of sedimentary basins in northwest Europe was governed by the major plate interactions that accompanied the Palaeozoic consolidation of the Pangean megacontinent, the Mesozoic disintegration of the megacontinent that led to the opening of the North Atlantic and the Tethys, the late Mesozoic and Cenozoic Alpine collision between Africa and Eurasia, and the Cenozoic opening of the Norwegian-Greenland Sea and the Arctic Ocean. During its evolution the megatectonic setting of the northwest Europe changed repeatedly, whereby each cycle left its geological mark. Tectonic elements emplaced during one cycle became repeatedly reactivated during subsequent cycles. Through time a number of genetically different sedimentary basins developed; of these some are stacked on top of each other, whereas others were destroyed by subsequent events. The ultimate recoverable hydrocarbon reserves in established accumulations in northwest Europe amount to some 64 x $10^9$ brl of oil and oil equivalent; the North Sea alone accounts for 65% of these reserves.

15 **Age and nature of the crystalline basement of the North Sea Basin.** Frost, R.T.C. (Koninklijke/Shell Exploratie en Produktie Laboratorium, Rijswijk, Netherlands); Fitch, F.J.; Miller, J.A. pp 43-57 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Crystalline basement rocks have been encountered in about thirty wells spread over the entire North Sea Basin. Material from about half of these is described in detail; acid plutonic rocks and metamorphic rocks from low-grade phyllite to high-grade augengneiss are all represented. Eleven $^{40}Ar/^{39}Ar$ age spectrum determinations have been carried out on samples recovered from wells throughout the basin. Together with previous age determinations, these produce a consistent pattern of Silurian metamorphism and igneous intrusion. Some detailed analyses indicate earlier metamorphic phases and later overprinting events. The Caledonides of Scotland and Norway are linked across the northern North Sea in a belt of medium- to high-grade metamorphic rocks with associated plutons. However, a synchronous, but possibly less metamorphosed, branch of the Caledonian system runs southeastwards under the Central Graben and south of the Ringkobing-Fyn-Mon High, probably to join the Late Silurian fold belt under the Polish Trough.

16 **Regional interpretation of North Sea gravity data.** Donato, J.A.; Tully, M.C. (Inst. of Geological Sciences, Edinburgh, England). pp 65-75 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Institute of Geological Sciences has recently completed a gravity survey of the UK section of the North Sea. The results of this survey are presented in the form of a contoured Bouguer anomaly map. In order to investigate the broad scale features of the observed gravity field, nine long two-dimensional gravity models have been considered. These show that the observed gravity data cannot be adequately explained solely by the effect of the low density sediments within the major sedimentary basins of the area. Once the effect of the sediments is removed, the dominant feature throughout the whole area is a long wavelength gravity high of amplitude 75 to 100 mGal and width 100 to 200 km. This high is similar to gravity anomalies observed over some other continental rifts and is attributed to a deep seated density contrast, possibly involving crustal thinning beneath the Viking Graben, Outer Moray Firth Basin and Central Graben. It is proposed that the crustal thinning took place during the rifting phase of basin development and that the regional subsidence which followed can be explained in terms of an elastic flexure response to loading of the lithosphere.

17 **Regional seismic structure maps of the North Sea.** Day, G.A. (Inst. of Geological Sciences, Edinburgh, England); Cooper, B.A.; Andersen, C.; Burgers, W.F.J.; Ronnevik, H.C.; Schoeneich, H. pp 76-84 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

1:2,500,000 scale structure maps have been compiled corresponding to the following horizons: Palaeocene ash marker; Top Cretaceous, including Danian Chalk; Base Cretaceous; Top Triassic; Top Bacton Group; Top Zechstein; Base Zechstein. They have been derived mainly from larger scale isochron maps produced from oil company seismic data supplied to national authorities. Depth conversion was carried out using generalized formulae derived from local well data. The contour interval is 250 m for the uppermost two horizons and generally 500 m for the others. Important structural features of the North Sea are demonstrated by the maps and are described in the text. Seismic events are related to the geology, and the structural evolution of the North Sea is briefly discussed.

18 **Caledonides: their influence on the stratigraphy of the Northwest European continental shelf.** Johnson, R.J.; Dingwall, R.G. (British National Oil Corp., Glasgow, England). pp 85-97 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Caledonide mountain belt has had a significant effect on the geological history of the northern part of the UK Continental Shelf. A pattern of subsidence and uplift related to Caledonide tectonics persisted throughout the Mesozoic and Cenozoic, although its influence was more pronounced in some areas than in others. This paper attempts to relate the predominant tectonic expression of the Caledonides - the half graben - to structural and stratigraphic conditions in the northern part of the UK Continental Shelf throughout the Mesozoic and Cenozoic, and to identify the manner in which major regional fault patterns were a persistent controlling influence on local sedimentation. The Caledonide lineations, probably due to differing depths of burial, also modified the effects of the later stress patterns to varying degrees.

19 **Structural framework of the central and northern North Sea.** Threlfall, W.F. (Esso Exploration and Production UK, Surrey, England). pp 98-103 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The major tectonic features in the offshore central and northern North Sea can be interpreted and predicted in terms of the basement structural grain. Basin development along pre-existing zones of basement weakness began in the early to mid-Jurassic, culminated in the earliest Cretaceous and was superimposed upon the Permo-Triassic basins. Further structural movements at the end of the Cretaceous, Palaeocene and Late Miocene emphasized the basin framework. Interpreted Landsat imagery and geological maps of onshore Scotland demonstrate three major structural lineations; a northeasterly Caledonide or Great Glen system, an east-northeasterly Midland Valley system, and an unnamed east-west trend defined by valley, loch and stream directions. A strong northwest lineation is also apparent in the Lewisian metamorphic basement in northwest Scotland. All of the onshore trends can be recognized offshore when the azimuths of faults breaking the Jurassic section are measured. The north-south fault trends of the North Viking Graben have been attributed to continental extension but they could alternatively be interpreted as the tensional release direction of the Great Glen left lateral shear system. This could also explain the fault and basin asymmetry.

20 **Structural evolution of the North Viking Graben.** Challinor, A.; Outlaw, B.D. (British National Oil Corp., Glasgow, England). pp 104-109 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The structural evolution of the North Viking Graben is discussed in terms of a radically new method of structural analysis which utilizes a strain ellipsoid model of progressive three-dimensional spherical harmonic deformation. The Viking Graben has evolved in response to gravitational stress related to continental separation and the formation of the North Atlantic Ocean. The initial deformation resulted in the formation of major domal features underlain by thinned continental crust. These features developed in the Permian over the present area of the North Sea. By early Triassic times increased gravitational stress resulted in downfaulting of the crestal areas of these domal features forming the present North Sea graben system. The North Viking Graben forms the northernmost part of this system and is orientated approximately north-south. Continued deformation resulted in the development of smaller antiformal and synformal features during the Triassic and early Jurassic, with the synformal areas acting as depositional basins within the main graben area. With progressive deformation faulting occurred, and the ellipsoid model predicts that the synforms were upthrown and the antiforms downthrown. The deformation

reached its zenith in late Jurassic-early Cretaceous times, after which the Viking Graben has behaved as a simple subsiding trough. The upthrown synformal blocks form the major petroleum traps of the northern North Sea. The relationships between tectonic activity and sedimentation are presented in detail and the model is shown to be a useful tool in the prediction of the stratigraphy of the fault block hydrocarbon traps.

21 **Sole pit inversion tectonics.** Glennie, K.W.; Boegner, P.L.E. (Shell UK Exploration and Production, London, England). pp 110-120 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The relatively narrow Sole Pit Basin trended northwest-southwest, straddling Quadrant 48 of the UK Southern North Sea northeast of the Dowsing Fault. Within the basin, sedimentation was probably almost continuous from the Permian to the Late Cretaceous, when final uplift resulted in erosion deep into the Jurassic sequence. Comparison of the sonic velocities of the Bunter Shale, measured in wells both within and beyond the basin limits, indicates that the uplift locally may have exceeded 5000 ft. Positive inversion affected the northeast side of the basin only during the Early Cretaceous, whereas the southwest side was not uplifted until the latest Cretaceous; the basin axis had some effects of both. The Sole Pit area is traversed by many northwest-southeast faults. Both the earlier basinal subsidence and the later inversion are believed to have been reactions to stresses generated by events beyond the limits of the North Sea. These have resulted in strike-slip offsets of mostly minor displacement both in the lateral and in the vertical sense.

22 **Tectonic significance of post-Carboniferous igneous activity in the North Sea Basin.** Dixon, J.E. (Grant Inst. of Geology, Edinburgh, England); Fitton, J.G.; Frost, R.T.C. pp 121-137 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Petrology, whole-rock major- and trace-element analyses, and mineral analyses are used to establish the magmatic character of several new suites of extrusive and hypabyssal rocks from the North Sea Basin. This information, together with published data from Forties, Zuidwal and on land, is used to develop models for the principal Permian and mid-Jurassic to mid-Cretaceous tectonomagmatic events. Permian volcanics mostly occur along the northern flank of the Mid North Sea-Ringkobing High and are mildly alkaline (transitional) basalts, hawaiites and associated minor silicic extrusives. This apparently bimodal association is echoed in northern Germany prompting the extension northwards of existing basin-and-range analogue models to include the Oslo Rift. New $^{40}Ar/^{39}Ar$ age determinations and stratigraphic constraints show that Jurassic to mid-Cretaceous activity occurred mainly in three episodes: 175 to 165 Ma, 145 to 130 Ma and 95 to 110 Ma, approximately coeval with known tectonic phases. It is all of a consistent moderately to strongly undersaturated character: Middle Jurassic nephelinites (Egersund Basin) coeval with Forties alkali basalts; Lower Cretaceous phonolites and leucite-bearing lavas (Zuidwal), olivine nephelinites and basanites (South Netherlands) and a potassic minor intrusion (central North Sea); mid-Cretaceous olivine nephelinites and alkali basalts in the southern North Sea.The Jurassic phase resembles early Miocene activity in the Kenyan segment of the East African rift, but erupted volumes in the North Sea then and subsequently are negligible by comparison. Lithosphere stretching also passively elevates mantle rocks at the lithosphere/asthenosphere boundary, thereby inducing melting. Different vertical and horizontal distributions of stretching can account for some of the magmatic and tectonic variations between different North Sea extensional episodes, and perhaps help to explain rift-zone diversity in general.

23 **Temperature, thermal gradients and heat flow in the southwestern North Sea.** Oxburgh, E.R.; Andrews-Speed, C.P. (Univ. of Cambridge, England). pp 141-151 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Logs and samples of cores and cuttings from 130 wells in the southwestern North Sea (UK sector) have been studied and measurements of thermal conductivity have been carried out on 230 samples. Maps of thermal gradient, thermal resistance to 1000 m and 2000 m depth, heat flow, and temperature at 1000 m and 2000 m depth are presented. Average heat flow in the area studied is between 70 and 75 MW $m^{-2}$, somewhat higher than on the mainland to the west (60MW $m^{-2}$). The heat flow pattern matches that on land reasonably well and has a northwest-southeast trend. At 2000 m the combination of heat flow and thermal resistance seems to provide a reliable basis for temperature prediction at that depth. Moderately high temperatures in the west arise from the higher heat flow in the area, while the high temperature in the east and northeast results from the thick insulating cover of Tertiary sediments. Temperature anomalies occur in the neighborhood of salt domes which can only partly be explained.

24 **Geothermal gradients of the Northern North Sea Basin, 59 to 62°N.** Carstens, H.; Finstad, K.G. (Saga Petroleum a.s., Sandvika, Norway). pp 152-161 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Subsurface formation temperatures have been determined from bottom-hole temperature measurements taken during wireline logging. The standard corrections used for such data have some inherent errors, which implies that temperature estimates for many formations may be inaccurate unless supported by multiple readings. These inaccuracies could be greatly reduced by improving well-site procedures during logging. A stratigraphy-related pattern of geothermal interval gradients is recognized in the East Shetland Basin (including the Tampen Spur, Viking Trough and Horda Rim) and possibly also on the Horda Platform: Tertiary gradients of 30 to 40°C $km^{-1}$; Cretaceous gradients of 15 to 30°C $km^{-1}$ and very high gradients of over 35°C $km^{-1}$ in the Jurassic fault blocks. Stratigraphic subdivisions of the temperature profiles are not justified for the Utsira High or the East Shetland Platform. Variations in interval geothermal gradients are explained by a combination of differences in lithology-related conductivity and subsurface fluid flow. The map of mean geothermal gradients for the northern North Sea shows that the higher gradients (>35°C $km^{-1}$) are associated with structural highs, while the lower gradients (<30°C $km^{-1}$) occur in the basins. These results are the reverse of the pattern found by other workers south of 59°N, which had earlier been classified as an inverted geothermal realm.

25 **Oils and source rocks of the North Sea area.** Barnard, P.C.; Cooper, B.S. (Robertson Research International Ltd., Gwynedd, England). pp 169-175 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Good source rocks for oil in the North Sea area occur as minor enrichments in the Devonian, Carboniferous, Permian and Lower Jurassic, but the richest and most extensive source rock is the Kimmeridge Clay and equivalent formations. The organic matter of the Kimmeridge Clay is a mixture of kerogen types, and their relative abundance reflects changes in palaeo-environment over the depositional area; oil-generating kerogen is dominant adjacent to the graben areas, and occasionally in small basins on the platform. Most North Sea oils are derived from this source rock and are usually paraffinic crudes displaying a wide range of gravities. With certain exceptions the oils are similar in general characteristics, but their geochemical fingerprints, like those of the source rocks, show great variety. Some oils occur as low gravity oils or non-producible tars as deep as 2000 m, and these are believed to be biodegraded. Oil generation and migration have taken place during the Tertiary.

**26 Zechstein facies and petroleum prospects in the central and northern North Sea.** Taylor, J.C.M. (V.C. Illing and Partners, Surrey, England). pp 176-185 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Zechstein carbonates have reservoir potential (1) in belts of good primary porosity associated with dolomitized barrier/shoal facies, and (2) in uplifted areas where secondary porosity has been induced by dissolution of evaporite minerals and collapse-brecciation. The Auk and Argyll fields represent type (2), whereas few wells drilled north of the Mid North Sea High appear to have penetrated the first type of section. However, striking similarities between carbonate-evaporite sequences of the Zechstein of the southern North Sea and of the Continent as far afield as Poland encourage the belief that facies models developed in these explored regions should also be valid in the central and northern North Sea, where wells in basinal positions have indicated a normal thick succession of four main evaporite cycles. While Zechstein carbonates could host hydrocarbons generated in other formations, there is a possibility of indigenous oil or gas generation in adjacent euxinic slope and basin facies, as in Germany and Poland; the petroleum potential appears to be limited by the thickness of these beds and by early lithification.

**27 Middle Jurassic North Sea Deltas with particular reference to Yorkshire.** Hancock, N.J. (Robertson Research International Ltd., North Wales, England); Fisher, M.J. pp 186-195 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Middle Jurassic Deltaic Series of Yorkshire is one of a series of individual deltas which formed around the Jurassic coasts of northwest Europe. Using detailed sedimentological and palynofacies studies, this paper demonstrates the various sand and shale environmental types and their geometry in the general deltaic environment. From these, a palaeogeographic picture emerges of a river-dominated delta with an extensive delta plain crossed by channels in a southerly direction. Coincidence with avulsions of the river system, short-lived marine embayments penetrated the delta plain, sometimes from the east, and sometimes from the south. The delta front area lay to the southeast, and is seen in offshore wells. This study provides an excellent model for many of the different sand environments in other deltas of northwest Europe, especially the Brent Sand delta. Comparison of Middle Jurassic delta successions throughout the North Sea Basin demonstrates different characteristic vertical sequences. The Yorkshire sequence is not an analogue for any of the others. It is clear that several different individual deltas were present, sourced by different rivers, whose similarities and differences may form a basis for their identification and for understanding their relationships.

**28 Basin development and sedimentation in the Middle Jurassic of the northern North Sea.** Eynon, G. (Paramount Resources Ltd., Calgary, Alberta). pp 196-204 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Palaeozoic structural elements had a fundamental influence on the development of the interlinked and fault-bounded Mesozoic basins superimposed upon them. Fault trends associated with the Jurassic basins follow three basic lineaments: (1) northeast-southwest trends of the Caledonian; (2) east-west trends of the Hercynian, and (3) north-south trends probably of the Saalian (Permian). The immediate control on the Middle Jurassic (Bajocian-Bathonian) sedimentation was a regional crustal arching as a result of mantle plume activity. This episode is evidenced by four features: (1) the erosion of Lower Jurassic deposits over a very large part of the North Sea; (2) the emplacement, at the focus of the uplift, of the Rattray Formation volcanics; (3) the development of a trilete radiating conduit system for the dispersal of the erosional products; and (4) a concentric distribution of facies about the focus. The five-fold lithostratigraphic subdivision of the Brent Formation in common usage is not supported by a sedimentological and depositional facies analysis of the rocks. It is more convenient in this context to consider the following breakdown: (5) Upper Bathonian delta lobe; (4) Lower Bathonian delta lobe; (3) End Bajocian-early Bathonian marine transgression; (2) Bajocian delta lobe; (1) Basal Sand.

**29 Integration of palynological and sedimentological methods in facies analysis of the Brent Formation.** Parry, C.C. (Univ. of Sheffield, England); Whitley, P.K.J.; Simpson, R.D.H. pp 205-215 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Detailed palynological studies of the Middle Jurassic Brent Formation of the East Shetland Basin in the northern North Sea are used to determine a suite of palynofacies in conjunction with detailed sedimentological analysis. The palynofacies are interpreted within the framework of the various depositional subenvironments that make up the gross deltaic environment of the Brent Formation. Two wells with completely cored Brent Formation sections, Conoco/BNOC/Gulf 211/19-4 and Conoco/BNOC/Gulf 211/24-4, are used as reference sections. The palynological and sedimentological facies analyses together with Schlumberger logs are integrated to provide inter-well correlations.

**30 Northern North Sea Jurassic unconformities, chronostratigraphy and sea-level changes from seismic stratigraphy.** Vail, P.R.; Todd, R.G. (Exxon Production Research Co., Houston, TX). pp 216-235 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Thirteen global unconformities and their correlative conformities (sequence boundaries) divide the strata of the Jurassic of the northern North Sea into twelve cycles. These twelve cycles comprise the Jurassic supercycle. Nine of the global unconformities are believed to be caused by rapid falls of eustatic sea level, three by slow falls followed by rapid rises, and one by an increased rate of sea-level fall. Four marine hiatuses were identified that are interpreted to be related to rapid rises of sea level. Fault block rotation occurred almost continuously throughout the Jurassic, causing tilting of beds. Unconformity recognition is enhanced by periodic truncation of tilted strata by lowstand erosion and/or onlap during the subsequent rises. Sequence boundaries caused by changes of eustatic sea level subdivide strata into a series of chronostratigraphic packages that can be correlated throughout much of the northern North Sea. Northern North Sea unconformities and coastal onlap are demonstrated on two seismic sections tied to well control. One section is from the United Kingdom portion of the north Viking Graben; the second is from the inner Moray Firth. Sequence boundaries and charts showing chronostratigraphy, relative change of coastal onlap, and ages of unconformities are shown for each seismic section. Comparison of relative change of coastal onlap charts and unconformity age with global charts indicates that the unconformities are caused by eustatic changes of sea level during the Jurassic supercycle. A Jurassic eustatic sea-level curve is constructed from short-term eustatic sea-level changes determined by comparing regional coastal onlap curves, stratal patterns and facies relations from the northern North Sea with a global chart of relative changes of coastal onlap.

**31 Subcrop of the Mid-Mesozoic unconformity in the UK area.** Fyfe, J.A. (Inst. of Geological Sciences, Edinburgh, England); Abbotts, I.; Crosby, A. pp 236-244 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Drilling in the UK offshore region has identified a consistent early Cretaceous feature which broadly correlates with the period of tectonism previously referred to as Late Cimmerian. Cretaceous subcrop and lap-out maps have been produced to illustrate various

aspects of this feature. A marked time-gap exists over most structurally high areas, although this may be locally obscured by movements of late Jurassic and mid-Cretaceous age. In contrast, near-continuous sedimentation from late Jurassic to earliest Cretaceous times can be demonstrated in basinal locations. A mid-Volgian-early Ryazanian period of regression is recognized and is represented in southern basins by a sequence of several minor disconformities. The variable development of the unconformity is attributed to a combination of regional eustatic changes and more local tectonic controls, the latter having a more significant effect in the northern basins.

32 **Mid-Cretaceous palaeontology and stratigraphy, central North Sea.** Burnhill, T.J.; Ramsay, W.V. (BP Petroleum Development Ltd., Aberdeen, England). pp 245-254 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Albian, Cenomanian and early Turonian microfaunas of the central North Sea are discussed and a zonal scheme comprising five foraminiferal biostratigraphic zones is outlined, using the most important common species. These zones are related to the major lithostratigraphic units of the middle Cretaceous in the central North Sea, which include the Cromer Knoll Group (Valhall and Rodby Formations) and the Chalk Group (Hidra, Plenus Marl and Herring Formations). These formations are capable of further subdivision on lithologic and electric log character. The mid-Cretaceous geological history of the central North Sea is described and involves a period of transgression followed by regression, erosion and further transgression. A significant nonsequence is recognized within the middle Cretaceous of the Buchan field. This is correlated with unconformities in the Moray Firth, the Dutch Bank Basin, the Witch Ground Graben, the Fladen Ground Spur and the Forties field area.

33 **Seismic stratigraphy of the North Sea Palaeocene deposits.** Rochow, K.A. (Inst. of Geological Sciences, Edinburgh, England). pp 255-266 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Stratigraphic analysis of Palaeocene well sequences on a genetic basis revealed that the basic sedimentary components comprise a series of early-late Palaeocene sand deposits, disconformably overlain by an upward coarsening late Palaeocene to earliest Eocene unit. Integration of the well sequences with seismic data resulted in a three-dimensional view of the shapes, relationships and distribution of these sedimentary bodies. The integrated analysis revealed that the Palaeocene sequence basically consists of an overlapping series of submarine fans, disconformably overlain by basinward prograding shelf-deltaic deposits. Sedimentary trends indicate a westerly source with progressive deposition towards the east. However, an axial depositional component in the Viking Graben becomes predominant in the Central Graben, indicating a southerly regional palaeoslope towards the overall Tertiary depocentre in the southern part of the Central Graben. The three-dimensional view thus obtained from the identification of the shapes, relationships and distribution of the larger genetic components of the Palaeocene sediments provides a valuable insight into the overall sedimentary process, including some of the controlling factors. This, in turn, facilitates a logical interpretation of regional facies distributions.

34 **Stratigraphical relationships of Palaeocene sands in the UK sector of the central North Sea.** Knox, R.W.O'B.; Morton, A.C.; Harland, R. (Inst. of Geological Sciences, Leeds, England). pp 267-281 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Four major sand units are recognized within the Palaeocene beds of the UK sector of the central North Sea. Two of these are largely confined to western parts of the area and possess heavy mineral assemblages indicating derivation from the Scottish Highlands. Deposition was accompanied by volcanism and wide-spread transgression in both cases. The other two units are restricted to eastern parts of the area, and possess heavy mineral assemblages indicating derivation from pre-existing sandstones on the Orkney-Shetland Platform. Changes in sand provenance and deposition are believed to be of tectonic origin, and probably resulted from crustal events leading to plate separation in the North Atlantic region in early Eocene times. Correlation of the North Sea post-Chalk Palaeocene sequences with those of southeast England indicates that the latter are stratigraphically incomplete, with only two of the four phases of central North Sea sedimentation being represented.

35 **Agglutinated benthonic foraminiferal assemblages in the Palaeogene of the central North Sea: their biostratigraphic and depositional environmental significance.** Berggren, W.A. (Woods Hole Oceanographic Inst., MA); Gradstein, F.M. pp 282-285 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The authors are engaged on a long-ranging study of the foraminiferal assemblages in various Mesozoic and Tertiary basins in North America and Europe. The present short article is a summary of their findings in the North Sea.

36 **Habitat of the Rijswijk oil province, onshore, the Netherlands.** Bodenhausen, J.W.A. (Shell Internationale Petroleum Maatschappij BV, Hague, Netherlands); Ott, W.F. pp 301-309 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Rijswijk oil province lies in the onshore portion of the West Netherlands Basin. This depocentre formed during the Mesozoic and was strongly inverted during the Sub-Hercynian and Laramide tectonic phases. Oil and gas accumulations are contained in reservoirs ranging in age from Middle Jurassic to Eocene, with main production from Upper Jurassic and Lower Cretaceous sandstones. The principal source rock is the Toarcian Posidonia Shale. In the northern part of the basin a first phase of hydrocarbon generation occurred prior to the basin inversion. As a consequence of inversion tectonics these hydrocarbons were destroyed by erosion during the Early Tertiary. In the southern parts of the basin a later phase of hydrocarbon generation took place during the Cenozoic. These hydrocarbons charged anticlinal traps that came into existence during the Late Cretaceous and Early Tertiary inversion of the West Netherlands Basin.

37 **Geological input to reservoir simulation of the Brent Formation.** Simpson, R.D.H. (Conoco Inc., Houston, TX); Whitley, P.K.J. pp 310-314 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Regional evaluation of the sedimentation of the Middle Jurassic Brent Formation of the northern North Sea establishes a framework within which more detailed sedimentological studies on a field-by-field basis can be fitted. These exploitation-orientated geological studies are aimed at providing a detailed reservoir description of a field to be used in reservoir simulation to predict dynamic field behavior. The methodology of integrating core studies with well-log correlations and petrophysical studies in the building of a simulation model is illustrated using the Ness Member of the Brent Formation in the Murchison field as an example.

38 **Refinement of the geological model of the Thistle Field.** Hallett, D. (BNOC (Development) Ltd., Aberdeen, England). pp 315-325 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Recent sedimentological work on the Thistle Field has identified the presence of particular environments within the Middle Jurassic deltaic framework, including barrier islands, tidal channels and distributary mouth bars. Synsedimentary faulting appears to have occurred, and there is evidence of an area of condensed deposition. SEM studies have demonstrated a diagenetic sequence ranging from overgrowth of authigenic quartz to the formation of kaolinite and illite. Pressure data demonstrate that the field is divided into three separate compartments.

39 **Reservoir geological model of the Brent Sands in southern Cormorant.** Budding, M.C.; Inglin, H.F. (Shell UK Exploration and Production Ltd., London, England). pp 326-334 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Analysis of cores of the Brent Sands from the southern part of the Cormorant field permitted the construction of a depositional model of the reservoir. The reservoir package consists of a regressive sequence of shelf sands, coastal barrier sheet sands, lagoonal and delta plain deposits. A coastal setting away from the direct influence of a river mouth is postulated. The spatial distribution of fifteen facies types was constructed according to their genetic interpretation. This led to the subdivision of the reservoir into four main units. The model accounts for marked lateral changes in thickness, reservoir quality, and sand continuity within individual units. Lateral facies changes indicate a northward progradation of the Brent delta and an approximately east-west oriented shoreline. The increase in thickness of the coastal barrier deposits towards the northnortheast is believed to reflect a decrease in progradation rate.

40 **Heather oil field.** Gray, W.D.T.; Barnes, G. (Union Oil Co. of Great Britain, Middlesex, England). pp 335-341 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Heather oil field, a late 1973 discovery in UK Block 2/5 from the Middle Jurassic Brent Sandstone, came on production in October 1978, less than five years from discovery. The structure, as revealed by early seismic data, is predominantly a northeast-striking westward tilted fault block within the Viking Graben adjacent to the East Shetland Platform. The main growth of the Heather structure occurred in late Jurassic times as shown by a truncated Brent section and onlap of overlying Upper Jurassic strata. Exploratory and development drilling has revealed a reservoir with five subunits in the Brent Sandstone. The unexpected incidence of faulting coupled with variable cementation has seriously limited pressure continuity across the field thereby delayibg the implementation of water injection. The Heather field has a 1400-ft oil column covering 6000 acres. Estimated in-place reserves are small in comparison with other north Viking Graben oil fields. Moreover, the complex geology encountered with the reservoir has caused a reduction in the recoverable reserves initially estimated from appraisal drilling.

41 **Geology of the Magnus oilfield.** De'Ath, N.G. (BP Petroleum Exploratie Mij. (Nederland) B.V., Hague); Schuyleman, S.F. pp 342-351 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Magnus is the most northerly field discovered to date in the North Sea, some 200 km north of Sullom Voe, Shetland. It is located within Blocks 211/12 and 211/7 which were awarded to BP in the 4th round of UK licences early in 1972. Water depths average 200 m. Although Magnus, as a pre-Cretaceous tilted fault block, is similar to other oil bearing structures in the Brent Province of the northern Viking Graben, its stratigraphy is significantly different. The reservoir is an Upper Jurassic sandstone considered to be the middle fan sequence of a submarine fan that rapidly prograded eastward over the Magnus area during the Kimmeridgian. The proven depositional thickness of this Magnus Sandstone varies from 2 m to more than 200 m, and a tentative correlation between wells is presented. Porosity and particularly permeability deteriorate markedly with depth due to the superimposed effects of structural history, depth associated diagenesis and the variation in depositional environment. The appraisal of the field and its geology are discussed in relation to the development of the Magnus oil accumulation.

42 **Brae oilfield area.** Harms, J.C. (Marathon Oil Co., Littleton, CO); Tackenberg, P.; Pickles, E.; Pollock, R.E. pp 352-357 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Several hydrocarbon accumulations were discovered between 1975 and 1977 in Block 16/7 in UK waters along the western edge of the Viking graben. By 1978, thirteen exploratory wells were completed, and emphasis for development planning focused on the southern part of the area. The southern part of the Brae area is unique compared with other documented North Sea fields. An oil column of about 1500 ft is contained in Upper Jurassic conglomerate and sandstone shed off the Fladen Ground Spur as it was uplifted by faulting and as the Viking graben subsided. This major fault zone places Upper Jurassic against Devonian rocks and is the important seal along the west flank of the field. The cap rock and likely oil source are provided by the Upper Jurassic Kimmeridge Clay, which drapes a low anticline and dips eastward into the basin. Stratigraphic changes within the reservoir interval are abrupt. The depositional setting is interpreted as coalescing fan deltas spilled into the basin from adjacent uplands. Conglomerate and sandstone were deposited mainly subaerially on fan-delta surfaces, whereas laterally adjacent siltstone was laid down as fringing marine foresets. Complex diagenetic events have overprinted these facies. Other hydrocarbon accumulations similar in setting to the Brae field undoubtedly await discovery.

43 **Piper oilfield.** Maher, C.E. (Occidental of Britain, Inc., Aberdeen, England). pp 358-370 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Piper oilfield lies in UK Block 15/17, near the eastern end of the Moray Firth Basin, 125 miles northeast of Aberdeen. The field was discovered in December 1972 and confirmed as a major oilfield in 1973. The Pl production well, spudded 10 October 1976, established commercial production 7 December 1976 at more than 30,000 brl/day. Twenty-eight wells have been drilled, four as water injectors to support a natural water drive of 250,000 brl/day. Production is 290,000 sbrl/day of 37° API, low sulphur oil, and original recoverable reserves are estimated to be 618 million brl. Production is from the Upper Jurassic Piper Sandstone, a high energy, marginal marine and marine, shallow shelf sandstone, with gross thickness of 165 to 465 ft. Kimmeridge Shale is the caprock over most of the field, but Upper Cretaceous marlstones provide the seal along some fault scarps where the Kimmeridge was removed during the Cenomanian. The field is comprised of three parallel, tilted fault blocks on the north edge of the Witch Ground Graben. Blocks I and II cover 7149 productive acres and have a gross reservoir column of 1312 ft, from 7200 ft subsea to the common oil-water contact at 8512 ft subsea. Block III to the southwest borders the Witch Ground Graben, and contains a small accumulation with a separate oil-water contact at 9199 ft subsea. Piper sand stratigraphy, reservoir performance, and development from a centrally located platform are discussed in detail.

44 **Reservoir geology of the Forties oilfield.** Carman, G.J.; Young, R. (BP Petroleum Development Ltd., Aberdeen, England). pp 371-379 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Forties oilfield was discovered in 1970 in Palaeocene sandstones of the Forties Formation. Development drilling and production of crude commenced in 1975. At the end of 1979 fifty-eight platform wells had been drilled and the planned plateau production

rate of 500,000 sbrl/day had been achieved. The continued acquisition and interpretation of geological data during the production build-up phase have resulted in a clearer appreciation of the rapid facies variations first observed in the appraisal and early development wells. The reservoir sediments are considered to have been deposited in a middle to lower submarine fan environment. The facies identified from cores from vertical associations which are related to specific depositional processes and are recognized on petrophysical logs. Lithofacies studies and log pattern analysis, together with pressure-decline and production logging data provide a practical means of correlating and mapping the complex sand geometry. This approach provides a 3-D model to assess reservoir performance and to optimize infill-well locations.

45 **Geology of the Barents Sea.** Ronnevik, H.C. (Norwegian Petroleum Directorate, Stavanger). pp 395-406 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Since 1973 the Barents Sea has been covered by regional geophysical investigations. The surveys include reflection seismic, refraction seismic, gravimetric and magnetometric measurements along 45,000 profile kilometers. Geological sea-bottom sampling at 1500 stations has been done along lines also covered by reflection seismic surveys. Structurally, the Norwegian part of the Barents Sea can be divided into three major provinces: the Barents Sea east of 25°E, the area between 20°E and 25°E, and the area west of 20°E. There is an increase in tectonic complexity towards the west. The major seismic units that can be mapped outcrop on the sea floor. It seems possible to date the major units by rock samples collected from the sea floor.

46 **Geology of the Norwegian Shelf between 62°N and the Lofoten Islands.** Jorgensen, F.; Navrestad, T. (Norwegian Petroleum Directorate, Stavanger). pp 407-413 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Norwegian Shelf between the North Sea and the Lofoten Islands has been a depositional area at least since the Carboniferous. A very thick succession (>12 km) of sedimentary rocks has been deposited. During the late Palaeozoic and early Mesozoic, sedimentation was fault-controlled and took place in half-graben basins. Subsequently the area seems to have become one broad basin. Near the Jurassic/Cretaceous boundary a new tectonic phase resulted in the area being differentiated into several basins and ridges. This relief was smoothed by sedimentation during the Cretaceous, and in the Tertiary the whole area was one epeirogenic subsiding basin.

47 **Petroleum geology west of the Shetlands.** Ridd, M.F. (British National Oil Corp., Glasgow, England). pp 414-425 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The area of greatest exploration interest west of the UK to date has been the shelf-edge due west of the Shetlands, that is, between latitudes 60° and 61° North. It lies on the eastern flank of the Faeroe Basin which was a major center of deposition following the phase of widespread Early Tertiary extrusive igneous activity. Sedimentary rocks as old as Palaeozoic are present on the southeastern flank, but the extent to which pre-Tertiary rocks occur beneath the rest of the Faeroe Basin is still unclear. Faulting was probably occurring as early as the Permo-Triassic, but the greatest period of faulting along the eastern margin of the Faeroe Basin was in the Late Jurassic and Early Cretaceous. Structures associated with those faults have formed the principal objective of exploration drilling to date. One such major horst is the Rona Ridge in which oil has been discovered beneath sealing Upper Cretaceous mudstones. It is reported to be the biggest oil accumulation so far discovered in the UK, although having a gravity of about 25° API coupled with reservoir complexities will make eventual production difficult. In the future, drilling activity will extend into the deeper parts of the Faeroe Basin, and success there will to a great extent depend on the industry's ability to map seismically the structure beneath the Lower Tertiary volcanic rocks and to distinguish igneous from sedimentary reflectors.

48 **Structure and stratigraphy of the Kish Bank Basin.** Jenner, J.K. (Amoco Europe Inc., London, England). pp 426-431 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Kish Bank Basin is an Upper Carboniferous to Jurassic half-graben some 30 km by 40 km in size, situated just east of Dublin in the Irish Sea. The first well, Amoco 33/22-1, was drilled on the southeast flank of the Basin; it proved a Westphalian B to Stephanian sequence of coal measures, 722 m thick, lying immediately below the Quaternary and resting unconformably on Lower Palaeozoic basement rocks of the Leinster Massif. Seismic interpretation indicates an additional sequence, up to 3000 m thick, of probable Permo-Triassic and Jurassic rocks against the western and northern boundary faults. The presence of halite in the upper part of the sequence is interpreted from seismic records and gravity data, and the occurrence of Liassic mudstones has been established by sea-floor sampling at the northern margin of the Basin. Thin Quaternary to Tertiary deposits cover most of the sea floor. Stratigraphy in the Kish Bank Basin is considered to be comparable with other Permo-Triassic basins in western Britain including the Ulster, Solway, Irish Sea, Cheshire and Worcester basins. A northwest trending dextral strike-slip fault crosses the basin producing a 6-km displacement of its margin, and is on trend with similar faults seen in Northern Ireland.

49 **Geology of the Cardigan Bay-St. George's Channel Basin.** Barr, K.W.; Colter, V.S.; Young, R. (British Gas Corp., London, England). pp 432-443 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The completion of the Llanbedr (Mochras) borehole on the northeastern margin of Cardigan Bay showed that a thick sequence of Mesozoic rocks was to be expected in Cardigan Bay. Subsequent geophysical (seismic) surveys by the IGS, and by Hydrocarbons Great Britain Ltd. (a subsidiary of British Gas Corporation) and other oil companies, have confirmed that both Cardigan Bay and the adjacent parts of St. George's Channel are underlain by a thick sedimentary sequence. Additionally, the drilling of shallow coreholes by the IGS around the margin of the bay, confirmed the presence of Middle to Lower Jurassic and Permo-Triassic beds. Following the issue of petroleum exploration licences in 1971 (and in subsequent years) and more detailed seismic surveys, a total of five exploration wells have now been drilled by several companies, including Hydrocarbons (Great Britain) Ltd. The sequences penetrated by these wells have revealed a stratigraphic succession comprising Lower Tertiary formations resting with strong unconformity on Jurassic rocks. An almost complete Jurassic succession from Portlandian to Hettangian is present in the center of the basin, although local non-sequences are evident in some areas. Beneath the Jurassic, Triassic red-beds and a salt series have been encountered, which rest with strong unconformity on Upper Carboniferous Westphalian shales, and possibly on older rocks.The seismic surveys have revealed a rather complex structural pattern influenced locally by salt tectonics, and by the persistence of Caledonian basement lineaments. Geochemical source rock studies of the Jurassic shales in the Llanbedr (Mochras) borehole and in one of the offshore wells have shown that the shales, for the most part, have a low organic content, and consequently have poor hydrocarbon source rock potential.

50 **Fastnet Basin: an integrated analysis.** Robinson, K.W. (National Board for Science and Tech., Dublin, Ireland); Shannon, P.M.; Young, D.G.G. pp 444-454 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Exploration drilling in the Fastnet Basin, some 140 km south of Ireland, has confirmed the existence of a thick Mesozoic/Tertiary sedimentary sequence. Largely continental Triassic sands and redbeds are succeeded by Lower Liassic shelf limestones and deeper water Upper Liassic shales with localized regressive Sinemurian sands. Middle and Upper Jurassic strata are largely absent. Following extensive Cimmerian uplift and erosion, a return to arenaceous continental conditions in the Wealden was followed by gradual subsidence and marine transgression in Late Cretaceous times. A mid-Tertiary marine limestone unconformably overlies the Cenomanian to Campanian Chalk, and is succeeded by deeper water shales with sand intercalations. The basin is structurally dominated by a Caledonoid northeast-southwest dip-slip fault system involving down-to-the-basin fault-block movement, and has a secondary northwest-southeast strike-slip fault set. The major rifting is interpreted as having taken place in Middle Jurassic times, while basin inversion is recognized as a result of renewed movement in Cretaceous and Tertiary times. Basic intrusives associated with a major northwest-southeast fault zone, which bisects the basin, have been dated as Middle Jurassic. Potential hydrocarbon reservoirs occur as Triassic, Liassic and Lower Cretaceous sands, while potential source rocks have been found in the Liassic shales.

51 **Continental margin from the Porcupine Seabight to the Armorican marginal basin.** Roberts, D.G. (Inst. of Oceanographic Sciences, Surrey, England); Masson, D.G.; Montadert, L.; de Charpal, O. pp 455-473 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The continental margin between the Porcupine Seabight in the north and the Armorican margin in the south is topographically and geologically complex. The deep trough comprising the Porcupine Seabight is flanked oceanward by the Porcupine Ridge and contrasts with the gentler slopes of the margin near the Goban Spur. Further south, the northern or Armorican margin of the Bay of Biscay is characterized by a steep slope cut by many canyons. Regional multichannel seismic surveys of the margin extending from the shelf to the deep ocean have been made by the Institute of Oceanographic Sciences and the Institut Francais du Petrole. These surveys, aided by the results of dredging and three sites drilled during Leg 48 of the International Phase of Ocean Drilling, are used to present the regional structure and stratigraphy of the margin and a tentative evolutionary model. Between the Goban Spur and the Armorican Basin, the structure consists of a series of tilted and rotated fault blocks downthrown consistently toward the ocean and occurring in water depths up to 4500 m. Overlying Cretaceous and Tertiary sediments are thin beneath the Goban Spur but thicker in the Armorican Basin. The Porcupine Seabight appears to be a deeply subsided basin containing a prominent, probably extrusive body in its northern part, and is underlain in the south by the tilted blocks of the Goban Spur. The origins of the Seabight are enigmatic, but it seems unlikely to be underlain by oceanic crust.The complex structure of the margin has resulted from major rifting in Mid Jurassic to Early Cretaceous time, although there may have been minor earlier phases. Spreading in Biscay began in the Aptian, although rifting was still taking place west of the Goban Spur at this time. Spreading took place west of the Goban Spur and in the Rockall Trough during the post-Albian pre-Campanian interval.

52 **Petroleum geology of the Bay of Biscay.** Soler, R.; Lopez Vilchez, J.; Riaza, C. (Hispanoil-Eniepsa, Madrid, Spain). pp 474-482 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Bay of Biscay is the result of three main tecto-sedimentary events: (1) Mesozoic distension controlling the development of central oceanic crust and the deposition of several thousand meters of sediment in marginal basins and platforms on both sides (symmetric period of opening from Triassic to Upper Cretaceous); (2) Pyrenean Eocene compression and related tecto-sediments, affecting the Spanish active margin; the French side remaining a stable margin (asymmetric period of partial closure); (3) post-orogenic distension since the Oligocene with transverse faults. The oil exploration activity in the Spanish margin of the Bay of Biscay is concentrated in the narrow continental platform as a continuation of the onshore traditional targets, and in two wider and deeper sub-platforms with specific new geological and technical problems. The coast intersects the northwest-southeast trending Cantabric structures which extend into the offshore; seismic surveys allows us to establish continuity between land and sea and to use the onshore models. Drilling activity is just starting with some encouraging results.

53 **Wytch Farm oil field, Dorset.** Colter, V.S.; Havard, D.J. (British Gas Corp., London, England). pp 494-503 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

In April 1968, a number of Production Licences were granted in the Wessex Basin to the BP/Gas Council partnership, which was operated by BP. Oil had already been discovered by BP at Kimmeridge in the 100% BP ML5, and production was established from fractured rocks in the Cornbrash. Subsequently, in 1964, BP drilled the Wareham No. 1 Well, which found oil in a thin fractured Inferior Oolite, but which was not production tested until 1970. A study of the Wessex Basin carried out by Gas Council (Exploration) (GC(E)) Ltd. in 1972 concluded that the Bridport Sands offered better and more predictable reservoir properties than the fractured rocks believed to be producing in Kimmeridge No. 1 and Wareham No. 1. On the assumption by GC(E) of the operatorship of the BP/GC(E) group, the Wytch Farm No. 1 Well was proposed to test a structure found on seismic data obtained by a BP seismic party. The well was spudded in December 1973, and found light oil in the Bridport Sand, trapped in an east-west-trending anticline, down-faulted to the south. Subsequent studies on the structural history of the area, together with geochemical data, suggested that the oil originated south of the Purbeck-Isle of Wight Disturbance from Jurassic sources, and could also have migrated into the Triassic Sherwood (Bunter) Sandstone of the Wytch Farm structure. To test this view, the Wytch Farm D5 Well was spudded in December 1977, and found light oil in the Triassic reservoir.To date, in addition to the wells mentioned, three delineation wells, six production wells and three water injection wells at Bridport Sand level have been completed, and a well has been drilled to the pre-Permo-Trias basement at location X14. Further delineation of the Triassic Sandstone accumulation is in progress.

### 0203 Drilling And Production

*REFER ALSO TO CITATION(S) 19, 21, 23, 43*

### 0209 Environmental Aspects

*REFER ALSO TO CITATION(S) 845*

## 03 NATURAL GAS

### 0302 Geology And Exploration

*REFER ALSO TO CITATION(S) 13, 14, 15, 16, 17, 18, 20, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 1249*

54 **Rotliegend gas fields of the K and L blocks, Netherlands Offshore (1968 to 1978): a case history.** Oele, J.A.; Hol, A.C.P.J.; Tiemens, J. (Nederlansche Aardolie Maatschappij BV, Assen, Netherlands). pp 289-300 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

Exploration has proven some fourteen gas fields varying in size between 3 and 25 x $10^9$ $m^3$ of recoverable gas. Five fields are in production or are at the development stage. Early seismic interpretation had indicated a strongly disturbed and geologically complex area where a favourable Rotliegend sand development was extrapolated below a Zechstein evaporite section in part of the region. After initial discouraging results it was realized that in certain areas inverted during the Laramide phase, the main reservoir had undergone considerable diagenesis caused by deep Cretaceous burial. The lateral differences in the tectonic history and sedimentological changes in the Chalk Group have resulted in a complex velocity pattern. With the data of some 60 exploration/appraisal wells good interval velocity control has been obtained. By combining seismic modelling and 3-D map migration techniques, a better definition of the remaining prospects can be achieved. In areas of strong halokinesis seismic definition of the Rotliegend objective remains problematic.

55 **Frigg gas field.** Heritier, F.E. (Societe Nationale Elf Aquitaine (Production), Paris, France); Lossel, P.; Wathne, E. pp 380-391 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Frigg gas field is located in the axial part of the Viking Basin. It straddles the border between the British and Norwegian sectors of the continental shelf at 60°N, and is located approximately 390 km northeast of Aberdeen. The discovery well was drilled in 1971 on the Norwegian Block 25/1 in 100 m of water. Gas occurs at a depth of 1850 m in a lobate submarine fan of Lower Eocene age which shows a closed area of 115 $km^2$ with a vertical closure of about 170 m. The gas probably is derived from underlying Jurassic source rocks. The initial recoverable gas reserves were estimated to be 227 x $10^9$ $m^3$ (7 x $10^{12}$ $ft^3$). Production, which started on 15 September 1977, comes from 48 wells drilled from two platforms, and the gas is brought ashore at St. Fergus in Scotland by a 360-km pipeline. The history of the discovery, general stratigraphy, structure, geologic history, and reservoir characteristics are discussed.

56 **Geology of the Morecambe gas field.** Ebbern, J. (British Gas Corp., London, England). pp 485-493 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D.* (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Morecambe gas field is situated in the northern Irish Sea, approximately 26 miles west of Blackpool. The field was discovered in 1974, with the drilling of Well 110/2-1 by Hydrocarbons Great Britain Ltd., a subsidiary of the British Gas Corporation. The reservoir rocks are Triassic sandstones (Sherwood Sandstone Group) at an average depth of some 3000 ft subsea. The sandstones are overlain by the Keuper Saliferous Beds (Mercia Mudstone Group) whih form an effective seal. The structure, 44 square miles in area, is basically a faulted anticline, the faults trending northwest-southeast and north-south. A northern area is isolated from the main field by a narrow graben. The porosity and permeability are described in relation to the stratigraphy and the diagenesis the sandstones have undergone. A possible development plan is outlined.

57 **Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland.** Colley, M.G. (Marathon Oil (UK) Ltd., London, England); McWilliams, A.S.F.; Myers, R.C. pp 504-510 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The Kinsale Head gas field, in the North Celtic Sea Basin, lies 33 miles off the southeast coast of Ireland in 300 ft of water. The field, at present providing the country's only hydrocarbon production, was discovered by Marathon in November 1971 with the third well (48/25-2) drilled in Irish waters. The structure is an elongate, Early Tertiary anticline covering an area of 47 square miles (30,000 acres) with a vertical gas column of 275 ft. Recoverable reserves are estimated as 1 x $12^{12}$ $sft^3$. The reservoir rocks are of Lower Cretaceous Aptian-Albian age, comprising a nearshore and transgressive sequence. The succession, equivalent to the Upper Wealden, Gault and Greensand of southeast England, is of terrestrial lower delta-plain facies, through a beach-sand deposit to a shallow marine tidal-shelf facies. The primary reservoir, the A Sand, was deposited as a stacked series of offshore bar-sands. Its average gross thickness is 125 ft with an average 90 ft net productive thickness. The beach-sand (the B Sand) and channel sands in the Upper Wealden provide minor reservoirs. Average depth to the top of A Sand is 2750 ft and to the top of B Sand is 2970 ft sub-sea. A 14-well development program from two platforms began in January 1978 and drilling was completed by October 1979. Production commenced in October 1978 with a contractual commitment to supply 125 million $ft^3$/day gas for 20 years.

58 (INIS-mf—6422, pp vp) **Study of the tightness of the rock cover of the Suchohrad-Gajary underground natural gas reservoirs using nuclear logging methods.** Bienik, J.; Saly, S. (Vyskum a Vyvoj Nafty a Plynu, Bratislava (Czechoslovakia)). [nd]. (In Slovak). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

# 05 NUCLEAR FUELS

## 0501 Reserves

*REFER ALSO TO CITATION(S) 137, 139, 142, 143, 144, 146, 147, 184, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, 1272, 1273, 1274*

59 **(CONF-7905120—) Geology and mineral technology of the grants uranium region 1979.** Rautman, C.A. (comp.). (New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)). 1980. 400p. New Mexico Bureau of Mines and Mineral Resources, Socorro. Order Number DE82900169.

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Forty six papers which were presented at the 1979 Symposium on the Geology of the Grants Uranium Region plus three more are included in this Proceedings. The papers cover the geology of the Grants region with discussions of exploration history and methods, individual deposits, petrographic investigations, field studies mining and experimental studies. Other topics such as ground water hydrology and severence taxes are also included. All papers have been abstracted and all but four have been indexed. (ATT)

60 **Alkali and alkaline earth element studies at Oklo.** Brookins, D.G. (Univ. of New Mexico, Albuquerque). pp 275-282 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

When mining recommenced at Oklo in 1977, a few samples from the reactor zones and from areas between zones of depleted 235-U became available for further studies. Of these, several have been analyzed which indicate the presence of fissiogenic Rb, Sr,

Ba, and Ba from Cs. Since the suite contains both high grade ore (reactor ore), low grade ore (no fission) and barren rock near ore zones, then presence of any of the fissiogenic elements of all three types of samples may allow an attempt for a material balance based on calculated fission yield and the total amount of fissiogenic alkali and alkaline earths present. Collectively, the data for the Group I, II, and III samples argue for the following conclusions: (1) Group I insoluble residues contain small amounts of fissiogenic Rb, Sr and Ba. (2) Group I leachates contain normal Rb and Sr arguing for post-reactor dilution in the form of veins, fracture fillings and grain coatings. (3) Group II leachates are more enriched in fissiogenic Rb and Sr than the corresponding insoluble residues. (4) Group III leachates are more enriched in fissiogenic Sr, and some in fissiogenic Rb, versus the insoluble residues which contain normal Rb and some which contain fissiogenic Sr. (5) Loss of fissiogenic Rb and Sr from high grade reactor ore and fixation of an unknown, but possibly large, quantity of fissiogenic Rb and Sr in the periphery of the reactor zones is indicated. (6) The barium data (groups I, II, III) argue for retention of (135/137)-Cs in the overall system until at least 26 million years after reactor shutdown; the presence of 138-Ba is inferred because of the enrichments of (135/137)-Ba, but background barium is too high to allow an accurate assessment of barium retention versus migration. (7) A material balance for fissiogenic alkali and alkaline earth elements is not possible at this time due to lack of adequate samples from edges of, and in between high grade reactor zones.

61 **Uranium resources, supply and demand.** Bowie, S.H.U. pp 49-55 of Availability of strategic minerals. Jones, M.J. (ed.). London, England; Institution of Mining and Metallurgy (1980).

From National symposium on the availability of strategic minerals; London, UK (20 Nov 1979).

The subject is covered under the following headings: uranium deposits and their distribution (vein deposits, uranium in sandstones, uranium in conglomerates, other uranium deposits); reserves and resources; constraints on uranium availability; probable production capacities; supply versus demand; methods of alleviating possible uranium shortages; strategic implications for the United Kingdom; conclusions.

62 **Energy analysis applied to uranium resource estimation.** Mortimer, N.D. (Sunderland Polytechnic (UK)). pp 79-92 of Uranium and nuclear energy. Proceedings of the fourth international symposium held by the Uranium Institute, London, September 10-12, 1979. London, England; Mining Journal Books Ltd (1980).

From 4. international symposium on uranium and nuclear energy; London, UK (10 Sep 1979).

It is pointed out that fuel prices and ore costs are interdependent, and that in estimating ore costs (involving the cost of fuels used to mine and process the uranium) it is necessary to take into account the total use of energy by the entire fuel system, through the technique of energy analysis. The subject is discussed, and illustrated with diagrams, under the following headings: estimate of how total workable resources would depend on production costs; sensitivity of nuclear electricity prices to ore costs; variation of net energy requirement with ore grade for a typical PWR reactor design; variation of average fundamental cost of nuclear electricity with ore grade; variation of cumulative uranium resources with current maximum ore costs.

63 **Uranium in Niger.** Koutoubi, S. (Ministry of Mines and Hydrology (Republic of Niger). Office National des Ressources Minieres (Onarem)); Koch, L.W. (Continental Oil Co. Inc.). pp 93-110 of Uranium and nuclear energy. Proceedings of the fourth international symposium held by the Uranium Institute, London, September 10-12, 1979. London, England; Mining Journal Books Ltd (1980).

From 4. international symposium on uranium and nuclear energy; London, UK (10 Sep 1979).

The subject is discussed under the following headings: the country; governance of mineral resources; regulation of the mineral industry; taxation of uranium production; establishment of mining companies; uranium resources; geologic setting; projects in production; projects under development; exploration projects; benefits of uranium production; infrastructure.

64 **Speculative uranium resources: their location and magnitude.** Taylor, D.M. (Nuclear Energy Agency, 75 - Paris (France)); Cameron, J. (International Atomic Energy Agency, Vienna (Austria)). pp 481-505 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

During the first phase of the International Uranium Resources Evaluation Project (IUREP), data relating to the uranium potential of 185 countries were compiled and reviewed. Using these data, the NEA/IAEA Steering Group on Uranium Resources identified areas of the world thought to be favourable for the location of additional uranium resources and estimated the magnitude of these "Speculative Resources". A high percentage of the Speculative Resources is expected to be located within the major producing areas but the study has highlighted several other areas which, although they do not have at present known economic uranium deposits, could make a major contribution to uranium reserves in the future. In many countries, it will be necessary to perform exploration work beyond that at present being undertaken if a significant portion of the Speculative Resources is to be found. To encourage this exploration, a further IUREP evaluation, called the "Orientation Phase", has been initiated.

65 **International Uranium Geology Information System.** Hansen, M.V.; Trocki, L. (International Atomic Energy Agency, Vienna (Austria)). pp 509-525 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

One of the primary efforts of the International Atomic Energy Agency is the dissemination of information. Within the broad framework of uranium resources, the Agency has published proceedings of many meetings organized by it, and has acquired a very large volume of geological data related to uranium resources, almost all of which are in different formats making a literature search for specific geological data elements a time-consuming, often unsuccessful endeavour. To put all data into a computer format with as much versatility as possible, the Agency engaged four special consultants who designed the International Uranium Geology Information System (INTURGEO). The system consists of four files with a fifth to be added later. These files are the Regional Reference File, Exploration Activity File, Deposit/Occurrence File, and International Summary File. The fifth will probably be the Ore Processing File. At present, the system is being serviced by the commercially developed ADABAS data management system, which may eventually be replaced by a smaller, more specific management system developed especially for INTURGEO to eliminate problems associated with broad usage of a commercial system, and to eliminate several awkward features of ADABAS. This would make easy transport and use of the entire system a simple matter. Development of INTURGEO is on schedule, but every effort is being made to bring it to full operation, including not only data storage and retrieval, but also processing of the data contained. At present the file contains slightly less than 500 records out of an anticipated 3000 and it is expected to be put to use almost immediately.

66 **Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline.** McLennan, S.M.; Taylor, S.R. (Australian National Univ., Canberra. Research School of Earth Sciences). pp 175-190 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Rare earth elements (REE) and other trace elements have been analysed in fine-grained sedimentary rocks from several important Lower Proterozoic units in the Pine Creek Geosyncline. Samples from the lower part of the sequence (Group I) appear slightly evolved from typical Archaean sedimentary rocks (AAS) towards typical Post-Archaean sedimentary rocks (PAAS). They have slightly lower Eu/Eu and higher LREE/HREE than AAS. Samples from the upper part of the sequence (Group II) resemble typical post-Archaean sedimentary rocks. These observations are consistent with REE patterns in the Lower Proterozoic Huronian succession of Canada and support the suggestion of a major, episodic change in the composition of the exposed upper crust at the Archaean-Proterozoic boundary. This change was probably related to large scale emplacement of K-rich granitic rocks into the upper crust at the end of the Arachaean. Analyses of U-rich sedimentary rocks from the Cahill Formation indicate significant REE mobility. Samples are highly fractionated and show decreasing La/Yb and increasing ΣREE (for samples with U approximately >1900 ppm) with increasing U content. These patterns also display a chondrite-normalized negative Eu-anomaly. U-rich samples (U approximately >1900 ppm) have a chondrite-normalized maximum at Tb. High HREE, U and low Th can be explained by carbonate complexing of U and REE in a low temperature hydrothermal ore solution. The solution was probably oxidizing with a pH>7.5. No evidence for a natural fossil nuclear reaction was observed in any of the samples. The high abundances of the HREE seem typical of U-ores from the Pine Creek Geosyncline and Rabbit Lake uranium deposit, Canada. Many of these elements are extremely efficient neutron absorbers and would thus significantly inhibit spontaneous chain reactions.

67 **Pine Creek Geosyncline. Statistical treatment of whole rock chemical data.** Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Winer, P. (Australian National Univ., Canberra). pp 191-208 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Statistical treatment of whole rock analyses was undertaken on 350 specimens collected within the Pine Creek Geosyncline which were analysed for 41 elements. Particular emphasis is given to main host rocks associated with uranium deposits, and to granitoids. Statistical methods employed include cluster analysis, correlation coefficients, means and variances. Correlations on the rock units that are host to the uranium deposits give the following results for uranium at the 99 percent confidence limit: Cahill Formation: U correlates with W, As, Nb, Mo, Pb, Li, Sc and Co; Masson Formation: U correlates with Li; Koolpin Formation: U correlates with Ti, P, Y, Ni, Cu, Zn, W, Nb, Pb and Li. The large number of rocks analysed in the Cahill Formation (143) made it possible to exercise correlation 'filters' at the 99 percent confidence limit, namely: a) U in excess of 500 ppm - U correlates with As, Nb, La, Ce, Mo, Pb and Co; b) U in excess of 40 ppm - U correlates with As, Nb, Mo, Pb, Sc and Co; c) U less than 40 ppm - U correlates with P; d) U less than 30 ppm - U shows no correlation. The correlation of uranium with the above elements suggests that they were transported in the uranium mineralising solutions. Of the granitoids studied the mafic-rich Nimbuwah Complex has the highest degree of correlation and clustering, which is attributed to its exclusively I-type nature and limited compositional range. The other granitoids investigated are of mixed S- and I-type parentage and range from mafic to felsic varieties; these factors account for the low to moderate degree of correlation of the elements.

68 **Geology of the Alligator Rivers Uranium Field.** Needham, R.S.; Stuart-Smith, P.G. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 233-257 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The uranium deposits of Ranger 1, Koongarra, Jabiluka One and Two, and Nabarlek are in the Alligator Rivers Uranium Field, the northeastern part of the Pine Creek Geosyncline. Lower Proterozoic metasediments, which were metamorphosed mainly to amphibolite-grade and multiply isoclinally folded at about 1800 Ma, host much of the uranium and overlie or grade into the Archaean to Lower Proterozoic granitoid Nanambu Complex. In the northeast of the Field the metasediments grade into schist and gneiss forming the outer parts of the Lower Proterozoic Nimbuwah Complex; the inner parts of this Complex contain granodioritic and tonalitic migmatite and granitoid rocks which were emplaced before the 1800 Ma event. The metasediments are intruded by pre-orogenic and post-orogenic tholeiitic dolerite, by synorogenic granite, and by later minor phonolite and dolerite dykes. All but the minor dykes are overlain with marked unconformity by Carpentarian (Middle Proterozoic) sandstone with basalt flows, which conceals older rocks over most of the southeastern half of the area. The pre-Carpentarian (pre-Middle Proterozoic) rocks are deeply weathered and lateritised and are covered extensively by Mesozoic and Cainozoic sediment. The uranium is mainly contained in the lower member of the Cahill Formation, comprising mica quartz schist, magnesite and carbonaceous schist, which is chloritised around the uranium occurrences and along faults, shears and some stratigraphic breaks. The ore zones are located in breccia. The stratabound nature of the ore suggests that it has formed partly syngenetically; however, epigenetic processes appear essential for the development of such high-grade deposits.

69 **Geologic setting of the East Alligator uranium deposits and prospects.** Hegge, M.R.; Mosher, D.V. (Pancontinental Mining Ltd., Sydney (Australia)); Eupene, G.S. (Geopeko Ltd., Darwin, Australia); Anthony, P.J. (Queensland Mines Ltd., Sydney, Australia). pp 259-272 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Since 1969, four major uranium deposits and a number of important prospects have been discovered in the East Alligator region of the Northern Territory. The region is now considered to be one of the most prospective in the world for locating further uranium reserves. Exploration activity in recent years, however, has been hampered as a result of government delays in processing new applications for exploration tenements. It is expected that this situation will continue until such time as the government has resolved the political problems associated with establishment of the Kakadu National Park, Aboriginal Land Rights and current mine development in the area. This paper briefly describes the geology of some deposits and prospects. It should be noted that certain prospects have not been included in this discussion because of the lack of sufficient data. The common geologic features are summarized to determine the most important similarities and possible ore controls. A brief comparison with the Athabasca Basin in Canada is presented. The regional geology has been presented by other authors (Needham and Stuart-Smith, this volume) and will not be repeated in this discussion. In summary, the authors hope to provide a greater insight into the different geologic environments of uranium mineralization in the East Alligator region and in this way aid in elucidating the metallogenesis.

70 **Geology and mineralisation of the South Alligator Valley Uranium Field.** Crick, I.H.; Muir, M.D.; Needham, R.S. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Roarty, M.J. (Mines Div., Department of Mines and Energy, Darwin, Australia). pp 273-285 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The South Alligator Valley Uranium Field contains thirteen small worked out mines and over fifteen prospects most of which are within a north-west trending belt 24km long by 3km wide. Uranium mineralisation is commonly associated with gold and is (1) epigenetic, (2) occurs in a variety of rock types but commonly within the Lower Proterozoic Koolpin Formation, (3) occurs close to a major unconformity between Lower Proterozoic and Middle Proterozoic (Carpentarian) rocks and (4) has ages of about 800 m.y. and 500 m.y. New evidence concerning the environment of deposition and possible age of the Koolpin Formation is discussed. Models of uranium mineralisation in this field range from syngenetic, with minor remobilisation, to hydrothermal. Models which best explain most features of the mineralisation propose that uranium was leached from the Edith River Volcanics by low-temperature groundwaters and redeposited in a reducing environment along faults and fractures in the unconformably underlying Koolpin Formation.

71 **Geology and exploration of the Rum Jungle Uranium Field.** Fraser, W.J. (C.R.A. Exploration Pty Ltd., Winnellie, Australia). pp 287-297 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Rum Jungle Uranium Field was discovered by a private prospector in 1949. A total of 3530 tonnes of uranium oxide was mined and treated from four ore-bodies by Territory Enterprises Pty. Limited who managed the Rum Jungle Project on behalf of the Australian Atomic Energy Commission until the closure of operations in 1971. One small low grade uranium orebody remains to be developed. Lead, zinc, copper, cobalt and nickel were found zoned sub vertically with uranium at one deposit. One medium sized lead, zinc, copper, cobalt and nickel deposit remains to be developed and one small copper deposit with minor uranium was mined. The basemetal deposits show a regional zoning relationship with the known uranium mineralization. Uranium and basemetal mineralization is hosted by graphitic or chloritic, pyritic shales at the contact with a magnesite. These rocks are in the lower part of a sequence of Lower Proterozoic sediments which unconformably overlie Archaean basement complexes. The sediments and complexes are displaced by Giants Reef Fault and sub-parallel shears and linears may further control mineralization. Nearly 50km of the prospective shale/magnesite contact was tested by total count radiometric surveys, various electrical methods, auger, rotary percussion and diamond drilling. The source for the uranium mineralization was probably the Archaean basement complexes from which uranium was initially deposited as protore by either chemical precipitation or clay adsorption in the shale units or as detrital placers in quartz pebble conglomerates immediately overlying the basement complexes.

72 **Stratigraphy of the Kapalga Formation north of Pine Creek and its relationship to base metal mineralization.** Goulevitch, J. (Geopeko, Winnellie, Australia). pp 307-318 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The lithology, stratigraphy and mineralization of the Kapalga Formation is described. An interdigitation of carbonaceous siltstones and mudstones, chert, ashstones and tuffaceous chert, greywacke, siltstone, mudstone and minor banded iron formation (b.i.f.) characterises the Formation. These rocks define a vertical facies transition between low energy sediments of the underlying Koolpin Formation, and high energy sediments of the overlying Burrell Creek Formation. This transition is interlayered with numerous ashstone-tuffaceous chert horizons which were deposited during the waning stage of Gerowie Tuff sedimentation. The boundary between the Kapalga Formation of the South Alligator Group and the Burrell Creek Formation of the Finniss River Group is strictly conformable in this part of the Pine Creek 'Geosyncline'. Relict devitrified shards have been recognised in the Gerowie Tuff in the Margaret Syncline and these observations along with whole-rock chemical analyses conclusively support claims by previous investigators that these rocks are volcanic derivatives. Base metal mineralization at Iron Blow and Mt. Bonnie occurs as massive, stratiform, sulphide-silicate-carbonate lodes. The deposits are at the same stratigraphic level towards the base of the Kapalga Formation and minor stratification parallel with bedding has been observed. These features, and the association of the lodes with mud-flow breccias, lead to the conclusion that the lodes are syngenetic in origin. Thermochemical consideration of the sulphide assemblages together with the temporal relationship between the mineralization and Gerowie Tuff point to diagenetic devitrification of the underlying tuffaceous rocks as the source of the mineralization. Recent publications of experimental data from reaction of seawater and volcanic glass provide information which supports this thesis, and suggests a seawater origin for the sulphur present.

73 **Mount Fitch copper and uranium deposits, Rum Jungle Uranium Field, N.T., Australia.** Berkman, D.A. (Australian Oil and Gas Co. Ltd., Sydney); Fraser, W.J. (C.R.A. Exploration Pty Ltd., Winnellie, Australia). pp 343-349 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Mount Fitch copper and uranium deposits are contained in chloritic, sericitic and graphitic schists of the Namoona Group and magnesite of the Batchelor Group. The main uranium deposit is confined to a major breccia zone in the magnesite. Total ore reserves are approximately 1500 tonnes $U_3O_8$. Secondary copper mineralization is contained in residual clays overlying the magnesite and reserves are estimated at 290,000 tonnes of ore with an average grade of 0.65 Cu. An interpretation of the structure suggests that the metasediments were initially folded during the orogenesis of the Pine Creek Geosyncline. Later faulting and cross folding, complimentary to Giants Reef Fault intensively brecciated the metasediments. It is suggested that the mineralization is syngenetic or introduced during the orogenesis of the Pine Creek Geosyncline and upgraded by later weathering which was most effective in the breccia zone, facilitated by the high permeability. The copper mineralization represents a major enrichment by removal of magnesite during weathering.

74 **Nature and significance of the occurrence of uranium in the Nanambu Complex of the Pine Creek Geosyncline.** McAndrew, J.; Finlay, C.J. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia). pp 357-362 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The mineralogy of the occurrence of the uranium in granitic rock types from the Nanambu Complex has been studied for seven localities in the Complex. Uranium is present in accessory zircon, monazite, xenotime, uranothorite, uraninite and apatite; in pseudomorphs of altered uraninite and uranothorite; in ferruginized and chloritized biotite; and as very minor amounts disseminated through altered feldspar. There is no concentration along grain boundaries, or fractures. Uraninite or pseudomorphs of altered, oxidized uraninite have been recognized at five of the localities. The accessory uraninite provides a source of mobile uranium for hydrothermal as well as supergene processes. Zircon in uraninite-bearing granitic rocks of the Nanambu Complex has a relatively high uranium content of 0.18-0.36%. This may represent the saturation level for uranium in zircon at the conditions under which the granitic rocks formed, and be a guide to the potential occurrence of uraninite, and thus of labile uranium, in such rocks.

75 **Mineralogy of the Jabiluka, Ranger, Koongarra and Nabarlek uranium deposits.** Ewers, G.R.; Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 363-374 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Alligator Rivers uranium deposits are stratabound within the Lower Proterozoic Cahill Formation. Quartz-muscovite-chlorite schists predominate in all deposits. Within areas of uranium mineralization, chloritization is intense with the partial or complete replacement of biotite, muscovite, garnet, amphibole, and feldspar. The breccia fragments are typically chloritic and/or sericitic quartzite, chert and strongly chloritized material. They are usually angular, laminated, and rotated. The textures and lithology indicate that brecciation occurred after the approximately 1800 m.y. regional metamorphic event, and that there was a high percentage of voids between the fragments. Breccia fragments have been cemented by chlorite +- quartz +- hematite +- chert +- graphite +- sulphides +- uraninite. The primary uranium mineralization is uraninite, though brannerite and coffinite have been reported. The uraninite occurs as disseminated cubes, which may coalesce to form clusters and strings; veins coating foliation planes; narrow lenses; rare spherules; and massive uraninite. Textures establish that uranium has been remobilized and redeposited within the ore zones.as been localized rather than widespread. The textural relations and composition of the chlorite cementing the breccia fragments vary considerably, and their significance in terms of ore genesis is open to interpretation. It is suggested that the presence of gibbsitic material, clay minerals, and clay-sized chlorite in this fracture filling chlorite may indicate an environment in which uranium was concentrated through adsorption. The tendency for the $Fe^{2+}/Fe^{3+}$ ratio of the chlorite cementing breccia fragments to decrease with increasing whole-rock uranium values, suggests that redox reactions involving Fe may have led to uranium deposition.

76 **Fluid inclusion and oxygen isotope studies of the Nabarlek and Jabiluka uranium deposits, Northern Territory, Australia.** Ypma, P.J.M.; Fuzikawa, K. (Adelaide Univ. (Australia)). pp 375-395 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

We lack a basic understanding of the solutions producing the uranium deposits of the Alligator Rivers Uranium Field (ARUF). Several theories have been proposed ranging from syngenetic, epigenetic hydrothermal, epigenetic metamorphogenic, surficial origin (Ferguson et al., this volume), and mobilization by evaporite deposits. As for a precipitation mechanism, we do not seem to find much beyond the presence of graphite in some ore-bearing and intra-formational strata, and pre-uranium sulphides, none of which reducing factors are common throughout all ore bodies. This study was initiated with the aim of obtaining direct fluid inclusion evidence of the solution transport and precipitation of uranium.

77 **Stable isotope study of three deposits in the Alligator Rivers Uranium Field, N.T.** Donnelly, T.H. (Commonwealth Scientific and Industrial Research Organization, Canberra (Australia)); Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 397-406 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Three major uranium deposits of the Alligator Rivers Uranium Field (Jabiluka One and Two, Koongarra, and Ranger 1), which occur in the Lower Proterozoic Cahill Formation have been isotopically examined. This study is so far the most extensive stable isotope investigation of minerals associated with uranium mineralisation in the Pine Creek Geosyncline. The data obtained relate to (1) the evolution of the Geosyncline, from approximately 2500 m.y. to younger geological periods, (2) the onset of bacterial sulphate reduction as a major process, and (3) the evolution of seawater sulphate sulphur isotope compositions to $^{34}S$ enriched values, shown from at least the Cambrian onwards. The isotope data have been obtained from sulphides, carbonates and organic matter (identified as graphite in the areas studied), from both ore-zones and adjacent sediments.

78 **Natural reactor studies.** Riley, G.H.; Korsch, M.J. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Mineral Physics). pp 407-416 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Proterozoic uraninite deposits in the East Alligator River area of the Pine Creek Geosyncline contain high grade zones which could have supported natural sustained fission reactions. Uranium isotopic abundance measurements on 39 samples from Koongarra, Jabiluka and Nabarlek do not provide evidence for significant $^{235}U$ depletion. Neodymium isotope measurements on a single sample from Nabarlek have no anomalous values that can be related to a fission product origin. A relatively high abundance of $^{143}Nd$ is interpreted as radiogenic from $^{147}Sm\alpha$-decay. While no

evidence for natural sustained fission results from this preliminary study, remobilization of uraninite may have had the effect of diluting isotopic anomalies to below detection levels.

79 **Petrology and geochemistry of alteration associated with uranium mineralization at Jabiluka, Northern Territory, Australia.** Binns, R.A.; Ayres, D.E.; Wilmshurst, J.R.; Ramsden, A.R. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia). pp 417-438 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

An aureole of retrogressive metamorphism in former amphibolite facies schists extends at least 200m from uranium ore zones at Jabiluka. Chloritization of biotite, and replacement of feldspar by sericite-chlorite aggregates, are the most distinctive reactions. Similar but more intense alteration occurs in the immediate vicinity of uraninite-bearing veins and breccia zones. This retrogressive metamorphism was not isochemical. Compared to their amphibolite facies parents, the altered schists are enriched in Li and Mg, and dramatically depleted in Na, Ca, Sr and Ba. There is little significant geochemical difference between schists in the outer portion of the retrogressed aureole and those closer to ore. However the immediate hosts to ore, within about 1m, are distinctly enriched in uranium associated with chlorite-septechlorite alteration products rather than with disseminated uraninite. Further but mild enrichments in Li and Mg occur, and the immediate hosts are also distinctly depleted in K and Rb. Compared to the country rocks, Jabiluka uraninite ores are significantly enriched in Ca, Sc, Y, and rare earth elements, and also in radiogenic Pb and certain chalcophile trace metals including Cu, As, Mo, Ag and Sn. Uranium appears to be its own best pathfinder at Jabiluka for exploration in unweathered rocks. Other geochemical characteristics of the ores and their host rocks may have applications to advanced stages of exploration programs, and they also provide a guide to possible pathfinder elements useful in weathered situations.

80 **Lead isotope studies at Jabiluka.** Gulson, B.L. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia); Mizon, K.J. (Commonwealth Scientific and Industrial Research Organization, Fuel Geoscience Unit, North Ryde, Australia). pp 439-455 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Analyses of sulphides and whole rocks from Jabiluka demonstrate the potential use of Pb isotopes in exploration for U ore deposits. As mineralization is approached, the $^{206}Pb/^{207}Pb$, $^{206}Pb/^{208}Pb$ and $^{206}Pb/^{204}Pb$ ratios increase dramatically. The oldest apparent uraninite ages are 1100 - 1300 m.y. from an extensively studied 10cm piece of drill core which contains finely disseminated sulphides associated with chlorite; the sulphides may have stabilized the oxidation of uraninite and thus inhibited loss of radiogenic Pb. Sulphides in this and some other samples contain excess radiogenic Pb derived from uraninite, as does one sample of chlorite. Chalcopyrite from a 'drusy' vein cutting uraninite has an apparent age of approximately 1380 m.y. and this places a minimum age on the U mineralization. Analyses of the other carefully selected uraninites give young apparent ages (approximately 400-900 m.y.) consistent with previous studies in the Alligator Rivers area. Six Jabiluka whole rocks do not define a linear array on any lead isotope plot. One sample with a $^{207}Pb/^{206}Pb$ ratio of approximately 0.038 exhibits disequilibrium of U and Pb, which may be the result of excess radium. Sulphide lenticles for nine samples located metres from U mineralization define a well-correlated line on a $^{207}Pb/^{206}Pb$ vs $^{204}Pb/^{206}Pb$ plot which has an intercept proportional to an age of 1380+-110 m.y. The apparent age of 1380+-110 m.y. does not correlate with any other major isotopic data from the area but is consistent with a later 'event' suggested by U-Pb zircon data, and a single uraninite age. Alternatively, this age may represent the time of uraninite mineralization at Jabiluka. A mechanism is proposed for transport of U by brines rather than $CO_2$-rich solutions.

81 **Uraninite and its alteration products, Koongarra uranium deposit.** Snelling, A.A. (Sydney Univ. (Australia)). pp 487-498 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The secondary uranium minerals so far identified at Koongarra occur in a manner, and are distributed in a pattern, which indicate the mode of their formation. In situ replacement of uraninite veins by the uranium-lead oxides curite, fourmarierite and vandendresscheite, and the uranyl silicates kasolite, uranophane and sklodowskite, occurred immediately above the footwall fault breccia, alteration diminishing towards the high grade ore zone beneath the hanging wall graphite schist unit. The surviving uraninites and uranyl silicates were, in turn, further altered to the uranyl phosphates renardite, dewindtite, saleeite, sabugalite, metatorbernite, and torbernite, during weathering of the host schists. These processes are attributed to the introduction into the primary ore zones from below of surficial groundwaters and to subsequent changes in their Eh and dissolved phosphate concentrations. Lateral groundwater movement in the weathered zone was also responsible for the formation of a secondary dispersion fan over the No. 1 Orebody.

82 **Movements of uranium and daughter isotopes in the Koongarra uranium deposit.** Dickson, B.L. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Mineral Physics); Snelling, A.A. (Sydney Univ. (Australia)). pp 499-507 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Radiometric disequilibrium has been found to occur in the Koongarra uranium deposit among host rocks and in a dispersion fan of weathered ore. High resolution gamma-ray spectroscopy was used to determine which daughter isotopes of uranium have been mobilized by measuring $^{230}Th$, $^{227}Th$, $^{226}Ra$, $^{214}Pb$ and $^{210}Pb$. Uranium was found to have moved slowly in the dispersion fan of uranium in the weathered zone above the main orebody whereas radium was mobilized in the deeper main orebodies. Radium deposition in the transition zone between the two ore zones was also found, indicating upward flow of groundwaters.

83 **Role of clay adsorption in genesis of uranium ores.** Giblin, A.M. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia). pp 521-529 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Experiments are described in which: 1) The distribution coefficient (Ksub(d)) of uranium between a simulated ground water (containing 100 μg/l uranium) and kaolinite, measured over the pH range 3.5 to 10, was found to reach a maximum of 35,000 at pH 6.5. 2) Sequential adsorption-reduction has been demonstrated as one mechanism whereby the enrichment of kaolinite by uranium can exceed 0.01%, the level predicted from Ksub(d) measurements when solutions contain <=100 μg U/l. The relevance of these results to current models for genesis of ores from the Alligator Rivers Uranium Field is to supply a mechanism for generation of economic deposits from waters containing very low levels of uranium. These results also suggest reasons for the antipathy observed between uraninite and base metal sulphide occurrences in the Alligator Rivers Field.

84 **Evaporites and uranium mineralization in the Pine Creek Geosyncline.** Crick, I.H.; Muir, M.D. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 531-542 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Gypsum and halite pseudomorphs are found in carbonate rocks of the Coomalie and Celia Dolomites and the Koolpin and Cahill Formations in the three uranium fields of the Pine Creek Geosyncline. Their presence indicates hypersaline intertidal to supratidal depositional environments for these formations. All the evaporites survived metamorphism at ca. 1800 m.y. which reached amphibolite grade in the Cahill Formation. Evaporites were predominantly anhydrite during metamorphism and were rehydrated to gypsum during the Middle Proterozoic (Carpentarian), and later replaced by carbonates, mainly magnesite. We suggest that the major uranium deposits were formed in a number of stages related to the complex history of these carbonates: (1) primary enrichment of uranium in evaporitic sediments; (2) extrusion of uranium-rich brines during diagenesis; (3) further release of uranium rich brines during metamorphism and (4) possibly still further releases during post-metamorphic phases. Additionally, evaporitic brines released during stages 2 to 4 scavenged uranium and other metals from surrounding sediments and basement before redepositing them along with the evaporite derived uranium. The major phase of uranium concentration in the deposits occurred during stage 4 when the evaporites were replaced by magnesite, which was associated with the formation of high magnesium chlorites. Density contrasts between the evaporites and surrounding sediments may have resulted in pre- and post-metamorphic diapirs. Some of the breccias containing uranium mineralization may have formed as a result of diapirism and/or from partial solution of the evaporites prior to their replacement by carbonates. Base metal mineralization, commonly associated with uranium deposits in the Rum Jungle Uranium Field may have had a similar genesis. We suggest that this model may also be generally useful elsewhere in explaining the formation of metal deposits associated with replaced evaporites.

85 **Origin of uranium mineralization at Jabiluka.** Binns, R.A.; McAndrew, J.; Sun, S.S. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia). pp 543-562 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Effective exploration for uranium deposits in the Pine Creek Geosyncline, or in similar environments elsewhere, requires sound genetic models for known ore occurrences. In the Alligator Rivers Uranium Field (ARUF) a major constraint to understanding the origin of mineralization is imposed by the scarcity of surface exposure and the present lack of mine workings. Between the broad regional setting and features observable in drill core there are few crucial data such as, for example, are necessary to assess possible structural controls of ore location. Great reliance must therefore be placed on microscopic, geochemical, and isotopic characteristics of ores and their host rocks. The following remarks derive from a study of drill hole intersections of the Jabiluka Two deposit and its environment, chosen to illustrate general features described by Rowntree and Mosher (1975), Hegge (1977) and Hegge and Rowntree (1978). Drill holes L153V, S180V and M096V were the main source of material, covering the deposit to a depth of about 300m below the Kombolgie unconformity. In addition, core samples to illustrate specific features were provided from other parts of the deposit by geologists of Pancontinental Mining Limited.

86 **Model for the development of economic uranium mineralization in the Alligator Rivers Uranium Field.** Ferguson, J.; Ewers, G.R. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Donnelly, T.H. (Commonwealth Scientific and Industrial Research Organization, Canberra (Australia)). pp 563-574 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Major uranium deposits occur in the Alligator Rivers Uranium Field (ARUF) within the Lower Proterozoic Cahill Formation. These are: Nabarlek, Jabiluka, Ranger and Koongarra. These deposits and many prospects occur within zones of major disruption and extensive retrogressive metamorphism. Uraninite and galena ages from this uranium field indicate two periods of possible mineralization or mobilization at approximately 1600 and approximately 900 m.y. A number of recent field, mineralogical and chemical results were investigated and evaluated and from this a model has been derived for mineralization in the ARUF.

87 **Athabasca basin unconformity-type uranium deposits. A special class of sandstone-type deposits.** Hoeve, J. (Saskatchewan Research Council, Saskatoon, Canada); Sibbald, T.I.I. (Saskatchewan Geological Survey, Regina, Canada); Ramaekers, P. (Saskatchewan Geological Survey, Subsurface Lab., Regina, Canada); Lewry, J.F. (Regina Univ., Saskatchewan (Canada)). pp 575-594 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Two major episodes of uranium metallogenesis are recognized in Northern Saskatchewan. The first is of late-Hudsonian age and gave rise to metamorphic-hydrothermal pitchblende deposits of simple mineralogy at Beaverlodge (primary mineralization: 1780+-20 m.y.). The second and more important episode of approximately Grenvillian age rendered unconformity-type deposits in the Athabasca Basin (primary mineralization: 1000-1300 m.y.). The late-Hudsonian deposits at Beaverlodge were overprinted by this second event and new deposits of complex mineralogy were formed in that area. The metallogenetic importance of a third and much later episode which gave rise to mineralization within the Athabasca Formation is uncertain at the moment. With regards to metallogenesis of the unconformity-type deposits, presently available evidence favours a diagenetic-hydrothermal rather than a near-surface supergene or a magmatic/metamorphic hydrothermal model. The diagenetic-hydrothermal model relates uranium mineralization to 'red bed-type' diagenetic processes in the Athabasca Formation involving post-depositional oxidation and leaching, which continued for several hundred million years after deposition. Ore deposits were

formed by interaction, under conditions of deep burial at elevated temperatures and pressures, of a uraniferous oxidizing Athabasca aquifer with reducing, graphite-bearing, metamorphic rocks of the basin floor. The large-scale convection required for such interaction may have been induced by mafic magmatic activity coeval with the episode of mineralization. The diagenetic-hydrothermal model displays close similarities with metallogenetic models developed for certain sandstone-type deposits.

88 **Uranium geology in the Amer-Dubawnt-Yathkyed-Baker Lakes region, Keewatin District, N.W.T. Canada.** Curtis, L. (Australian National Univ., Canberra. Research School of Earth Sciences); Miller, A.R. (Geological Survey of Canada, Ottawa, Ontario). pp 595-616 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Numerous showings of uranium occur in the Keewatin District of Central Canada. The uranium mineralization is found predominantly within Proterozoic supracrustals which unconformably overlie a basement complex consisting of granites, metasediments and metavolcanics. The Proterozoic rocks consist of an older shelf facies sequence of Lower Proterozoic (Aphebian) age which are unconformably overlain by the Middle Proterozoic continental Dubawnt Group. The Dubawnt Group comprises basal conglomerates and sandstones, which in the Baker Lake basin are overlain by subaerial alkaline volcanics and intercalated fluviatile sediments related to a period of rift tectonics. These are in turn overlain by calc-alkaline volcanics. A subsequent period of crustal stability is indicated by the development of a thick section of mature continental sandstones, possibly correlative with the Athabasca sandstone. Uranium occurs within granitoid basement rocks of probable Archaean age, as stratabound concentrations within Lower Proterozoic metasediments and as vein and disseminated mineralization in the vicinity of Lower-Middle Proterozoic unconformities. Fracture controlled and disseminated uranium is found in a diverse number of geological settings within the Dubawnt Group. Several of the uranium occurrences have economic potential further highlighting the comparison between the Keewatin and Pine Creek uranium provinces.

89 **Key Lake U-Ni deposits. A model for Lower Proterozoic uranium deposition.** Kirchner, G.; Lehnert-Thiel, K.; Rich, J.; Strnad, J.G. (Uranerz Exploration and Mining Ltd., Saskatoon, Saskatchewan, Canada). pp 617-629 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Key Lake deposits comprise one of the largest concentrations of uranium and nickel in the Athabasca basin of Saskatchewan. The principal hosts to mineralization are pelitic metasediments of the Lower Proterozoic (Aphebian) Wollaston domain, and the overlying Middle Proterozoic (Helikian) Athabasca sandstone. Ore controls include a major post-Athabasca strike fault within graphitic metasediments and the Lower-Middle Proterozoic (Aphebian-Helikian) unconformity. Principal uranium minerals include crystalline pitchblende (tetragonal $U_3O_7$), sooty pitchblende ($U_3O_8+X$) and coffinite. Mineralization is most intense at and up to 20 metres below the sandstone interface, within kaolinite and chlorite gouge formed through intense tectonic destruction and post sandstone hydrothermal alteration. Age dates of 960 to 1228 Ma are indicated for primary ore deposition. Younger dates of 89-370 Ma attest to numerous episodes of post depositional remobilization. Significantly, sandstone ore contains only sooty secondary pitchblende dating 107-250 Ma. This is considered strong evidence for a hypogene origin. Lower Proterozoic (Aphebian) pelites were syngenetically enriched in uranium. Progressive upgrading during the Lower Proterozoic (Hudsonian) Orogeny and pre-Athabasca weathering, culminated in a major hydrothermal remobilization into structurally and geochemically favourable traps at and below the Middle Proterozoic Helikian unconformity. Using Jabiluka as an example, the applicability of this model to deposits of the Alligator Rivers Uranium Field of Australia is discussed.

90 **Contribution to some Saskatchewan uranium deposits mainly from fluid inclusion and isotopic data.** Pagel, M.; Poty, B. (Centre de Recherches sur la Geologie de l'Uranium Vandoeuvre, France); Sheppard, S.M.F. (Centre de Recherches Petrographiques et Geochimiques, Vandoeuvre, France). pp 639-654 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Mineralogical, fluid inclusion homogenisation temperature and composition studies, and D/H, $^{13}C/^{12}C$ and $^{18}O/^{16}O$ isotope studies have been performed on the Cluff Lake and Rabbit Lake uranium deposits and their host rocks. The following aspects are emphasized: 1) Metamorphism of the basement in presence of an essentially carbonic fluid (granulite facies); 2) Evaporitic type of sedimentation with high Mg-Li-B- and organic matter at the beginning of the Athabasca basin sedimentation; 3) Presence of highly concentrated brines (approximately 30% eq. weight NaCl) during diagenesis of the sandstone; 4) Hydrothermal alteration (around 200°C), at the boundary between basement and cover. Solutions during at least one stage of uranium mobilization and deposition were very similar to these diagenetic brines from the point of view of temperature, pressure, salinity, Cl/Br and stable isotopes (D/H and $^{18}O/^{16}O$). $^{13}C/^{12}C$ ratios on $CO_2$ are consistent with a derivation from organic matter by thermal degradation. However chloritization cannot be related to this stage and is not yet understood. Diagenesis of the Athabasca sandstone was an important step in the formation of economic uranium concentrations.

91 **Deposit of Oklo and its natural nuclear reactors.** Gauthier-Lafaye, F.; Weber, F. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Sedimentologie et Geochimie de la Surface); Naudet, R. (CEA, 75 - Paris (France)); Pfiffelmann, J.P. (Mokta, Paris, France); Chauvet, R.; Michel, B.; Reboul, J.C. (Compagnie des Mines d'Uranium de Franceville, Mounana, Gabon). pp 663-673 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980). (In French)

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

In the Oklo uranium deposit, seven zones have been discovered since 1972, in which natural fission reactions took place. A geological and metallogenic study of the deposit and of the uraniferous asin of Franceville was made. The deposit of Oklo is situated in a detrital, sandstone-like and pelitic series belonging to the Francevillian. The Francevillian and the mineralization are dated as Middle Precambrian (1800-2000 M.A.). The Oklo ore is the result of two concentration stages. Uranium seems to have been fixed by hydrocarbons that were concentrated in oil traps. After a tectonic event, circulations of oxidizing solutions generated reconcentrations that are associated with hematite and have contents of $UO_2$ between 1 and 20%. The fission reactions developed in the high-graded ores which had formed during the last phase of $UO_2$ concentration. A thorough tectonic analysis of the ore deposit shows that high-graded ores and fission reactors are controlled by fractures. The working of nuclear reactors results in a local increase of

temperature which gave a rise to circulation of warm water. The results of this hydrothermal circulation and of the neutron bombardment are seen in a succession of facies surrounding the reactors. At the centre of the reactor all sedimentary structures have been destroyed; within the reaction zone the following clays mineral zones are founded: (1) 1 Md illite and ferrous chlorite corresponding to the common Francevillian sediment; (2) 2 Md illite, (3) magnesium chlorite and (4) 1 Md illite and chlorite-vermiculite in the very rich uraninite ore. These hydrothermal circulations also caused removal of silica toward the outer zones which reacted affecting the geometry of the reactors by fracturing.

92 **Uraniferous phosphorite and apatite-bearing gneisses in the Proterozoic of Finland.** Aeikaes, O. (Geological Survey of Finland, Kuopio). pp 675-681 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Uranium is known to occur in the Proterozoic of Finland (1) within the Lower Proterozoic/Archaean boundary zone, (2) as strata-bound mineralizations in the Lower Proterozoic (Karelian) quartzites, (3) in albitite and albite diabase dykes cutting across these quartzites, (4) as uraninite-carbonate veins in a Lower Proterozoic (Karelian) greenstone-phyllite formation in northern Finland, (5) in migmatized Lower Proterozoic (Svecofennian) schists in southern Finland, and (6) in metamorphic phosphatic rocks of the Lower Proterozoic (both Karelian and Svecofennian) schist belts. However, the uranium occurrences found so far are too small or of too low grade to be of economic importance for the present. Here, the uranium- and phosphorous-bearing (U-P-type) occurrences at Nuottijarvi, Lampinsaari, and Temo are briefly described, and the characteristics of this type of uranium mineralization are summarized. The U-P occurrences are usually bedded, and the host rocks include fine-grained apatite-quartz-feldspar rock, and apatite-bearing or phosphorite-banded dolomite and skarn rock. Uranium occurs as uraninite crystallites within the apatite grains; it may also be contained in the apatite as a substitute for calcium. The grade of the occurrences is usually 0.03-0.04% U and 3-5% $P_2O_5$, and their Th content less than 10 ppm. Radiometric U-Pb dates indicate that the U-P occurrences were most probably deposited 1900-2080 Ma ago and were subjected to regional metamorphism about 1880 Ma ago. The metamorphic grade varies from intermediate greenschist to high amphibolite facies. The U-P occurrences are interpreted to be syngenetic and of marine sedimentary or mixed sedimentary and volcanic origin. It is also suggested that the uraniferous phosphatic rocks and other Proterozoic phosphorite occurrences in Finland and Sweden may belong to a possible Lower Proterozoic phosphogenic province of the Baltic shield.

93 **Geology of uranium vein deposits (including Schwartzwalder Mine) in Proterozoic metamorphic rocks, Front Range, Colorado.** Voto, R.H. de (Colorado School of Mines, Golden (USA). Dept. of Geology); Paschis, J.A. (Rocky Mountain Energy Co., Golden, CO, USA). pp 683-692 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Schwartzwalder uranium deposit is one of many uranium vein occurrences in the Lower Proterozoic metamorphic rocks of the Front Range, Colorado. The principal veins of significant uranium content occur marginal to the Colorado Mineral Belt; are localized by structural dilation zones, vein junctions, fault deflections or branching; and occur dominantly within or at the contact of certain preferred metamorphic-stratigraphic units, particularly the siliceous, garnetiferous gneisses, where these rock units are broken by faults and fractures associated with the north-northwest-trending throughgoing faults. Uranium at the Schwartzwalder mine occurs primarily as open-space brecciated vein filling along the steeply west-dipping Illinois vein and numerous east-dipping subsidiary veins where they cut preferred metamorphic host rocks that are tightly folded. Uraninite occurs with molybdenite, adularia, jordisite, ankerite, pyrite, base-metal sulphides, and calcite in vein-filling paragenetic sequence. Minor wall-rock alteration is mainly hematite alteration and bleaching. Vertical relief on the developed ore deposit is 900 metres and still open-ended at depth. No vertical zonation of alteration, vein mineralogy, density of the subsidiary veins, or ore grade has been detected. The Schwartzwalder uranium deposit is of substantial tonnage (greater than 10,000 metric tons of $U_3O_8$) and grade (averaging 0.57% $U_3O_8$). Structural mapping shows that the Illinois vein-fault is a Proterozoic structure. Discordant Proterozoic (suggested) and Laramide dates have been obtained from Schwartzwalder ore. The data suggest, therefore, a Proterozoic ancestry of this heretofore presumed Laramide (Late Cretaceous-Early Tertiary) hydrothermal uranium deposit. The authors suggest a polygenetic model for the origin of the Schwartzwalder uranium deposit.

94 **Association of uranium and skarn development in the Mary Kathleen area, Queensland.** Cruikshank, B.I.; Ferguson, J.; Derrick, G.M. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 693-706 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The genesis of both the Mary Kathleen orebody and the garnet-rich skarns appears to be related to the release of the residual, hydrous phase of the crystallising Burstall Granite and associated rhyolite dykes. The fluid introduced many elements, including uranium, into the metasomatic system and possibly remobilised others. Decomposition of carbonate during alteration of marble gave rise to fluids rich in $CO_2$; it appears likely that these fluids transported uranium and the rare-earth elements to a suitable site of deposition, in this case an open-textured conglomerate. Deposition of uraninite and retrograde reaction of garnet to rare-earth-bearing allanite probably occurred during a period of decreasing $CO_2$ content of the metasomatic-mineralising fluid. The Cahill Formation in the Pine Creek Geosyncline lacks the high temperature skarn-type uranium enrichment found in the Mary Kathleen area, despite the similarity in metamorphic grade and the development of juxtaposed uranium-enriched granitoids. The main difference in lithology in the uranium host formation in the two areas is the predominance of and calcsilicate rocks in the Mary Kathleen area. The calcareous units in the Cahill Formation are volumetrically small compared with those in the Corella Formation at Mary Kathleen. Other differences between the two areas possibly relate to the compositions of the initial fluids associated with the granitoids and to their interaction with host rocks, as well as the involvement of connate hydrous solutions.

95 **Syngenetic model for some early Proterozoic uranium deposits. Evidence from Oklo.** Brookins, D.G. (New Mexico Univ., Albuquerque (USA). Dept. of Geology). pp 709-719 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Massive, vein-like accumulations of uranium in Early Proterozoic metamorphic rocks have conventionally been explained by hydrothermal processes, metamorphism of original syngenetic or early epigenetic sedimentary deposits, mechanical accumulations,

supergene processes, or some combination of these processes. Many of these deposits are located at unconformities and may be controlled by basement fault systems, but the unconformities are not necessarily the primary control for ore formation. Exploration of Proterozoic sedimentary basins is, for economic factors, usually restricted to the basin edges where distance to the unconformities is minimal. The 2.0+-0.1 billion year old Oklo uranium deposit is unique in that very high grade ore has apparently been derived from low grade ore in unmetamorphosed sedimentary rocks. Uranium was mobilized from the low grade ore zones and concentrated as high grade ore in fractures. Pitchblende-illite ($2M_1$ polytype)-chlorite-hematite-pyrite in the virtual absence of quartz and carbon is common in the high grade ore. Crystallization temperatures near 200°C at P=0.5-2 kb and Eh conditions favouring formation of either pyrite or hematite, in the pH range of 6-8 were likely. The reductant for the mobilized uranium was apparently carbon which was oxidized as fractures opened, thus also accounting for the absence of quartz. The high grade ore, concentrated in shale-rich material down-filled into broken sandstone layers, was then severely folded and fractured. In cross sections, then, much of the Oklo ore resembles cross sections of high grade uranium ore in metamorphic rocks. It is proposed that Oklo may either be a hybrid type of deposit or a precursor to typical deposits in metamorphic rocks noted in Canada and elsewhere. It is considered significant that the Oklo deposit is located within the sedimentary sequence and not at the unconformity between this sequence and the basement granitic massif.

96 **Continental weathering and development of palaeo-surface-related uranium deposits. Some genetic considerations.** Tilsley, J.E. (David S. Robertson and Associates Ltd., Toronto, Canada). pp 721-732 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The uranium deposits of the Alligator Rivers Uranium Field, Northern Territory, Australia, and the Athabasca basin area, Saskatchewan, Canada, are of major importance in terms of the world's future energy supply. It is believed that the most highly enriched of these deposits are the result of epigenetic concentration related to the weathering process. Subsequent modification may be related to thermal anomalies due to the heat of uranium decay in the ore during burial by younger sedimentary rocks. Involves preconcentration of uranium in Lower Proterozoic (Aphebian) carbonaceous pelitic and argillaceous sediments that were later altered to graphitic schists during regional metamorphism. Subsequent continental weathering released the uranium to surface and groundwater from which it was concentrated in suitable physical-chemical traps. It is proposed that naturally occurring, direct current electrical fields played a dominant role in deposition and preservation of the mineralization. This model supplies criteria useful to the exploration process as follows: 1) Lower Proterozoic (Aphebian) sediments are preferred source and host rocks. 2) High grade mineral concentration appears to be related to electrically conductive zones in the basement. These zones can be located and traced geophysically through significant thicknesses of cover rock. 3) Post-depositional remobilization of $UO_2$ for several hundred metres up into cover rocks may result from hydrothermal circulation due to heat of radiogenic decay of the ores. Such mineralization may be a useful guide to ore at depth. 4) Thermal anomalies are not to be expected at surface but detection of temperature rise near ore zones beneath cover rocks may be of some exploration value.

97 **Uranium deposits of the future.** Taylor, D.M. (Nuclear Energy Agency, 75 - Paris (France)); Cameron, J. (International Atomic Energy Agency, Vienna (Austria)). pp 743-750 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

A report was published by the OECD in December 1978 entitled 'World Uranium Potential: An International Evaluation'. This report, which was based on the first phase of the International Uranium Resources Evaluation Project (IUREP), contained an estimate of the world's 'Speculative Resources'. Using the data developed during the evaluation the authors have estimated that between 2 million and 4.5 million tonnes of the world's Speculative Resources could occur in deposits of the Proterozoic unconformity-related type and have indicated the areas of the world in which these deposits could be located. The areas which are already known to contain deposits of the unconformity-related type, notably Australia and Canada, have the greatest potential for further deposits of this type, but significant new resources could also be discovered in other areas of the world, in particular in the Francevillian sediments in central Africa and the sub-Roraima metamorphic rocks in the northeast of South America. In view of the projected uranium demand, and the possible constraints on the discovery and availability of many of the world's Speculative Resources, the authors emphasize the urgent need for exploration for these resources and in particular for those contained in deposits of the unconformity-related type.

98 **Symposium. Retrospect and discussion.** Taylor, G.H. (Commonwealth Scientific and Industrial Research Organization, Fuel Geoscience Unit, North Ryde, Australia); Rowntree, J.C. (Pancontinental Mining Ltd., Sydney (Australia)). pp 751-758 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

This paper reviews briefly and discusses some of the material presented during this Symposium. Much of the Symposium centred around two main questions: 1) What are the characteristic features of the known uranium mineralization in the Pine Creek Geosyncline. 2) How did the known uranium mineralization in the Pine Creek Geosyncline form. It is convenient to begin by reviewing briefly the models which were proposed during the Symposium. The present authors have had to base this review and discussion paper on the papers presented at the Symposium. They do not in any way seek to pass judgement on these papers, but attempt to make constructive comments and draw attention to some problems. While the Symposium is a landmark in our progress towards gaining a full understanding of uranium mineralization in the Proterozoic rocks of northern Australia, we look forward to further work which will confirm or modify some of the concepts put forward. For the most part we will not refer to mineralization other than of uranium. Indeed, most of this paper will be concerned with the very rich uranium mineralization which occurs in the Alligator River Uranium Field.

99 **Ground water geochemistry in the vicinity of the Jabiluka deposits.** Deutscher, R.L.; Mann, A.W. (Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Mineralogy); Giblin, A. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia). pp 477-486 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Seventeen exploration drill holes in the vicinity of the Jabiluka One and Jabiluka Two deposits were logged for Eh-pH and conductivity at 5 metre intervals to depths of up to 195 metres below ground surface. Forty-seven water samples from exploration drill holes, augered holes on the Magela flood plain and from two billabongs in the vicinity of the deposits were collected and analyzed. Analyses for pH and Fe were conducted in the field, and further analyses for major ions $Ca^{2+}$, $Mg^{2+}$, $Na^{+}$, $K^{+}$, $SO_4^{2-}$, $Cl^{-}$, $HCO_3$- and Si and minorelements Zn, Cd, Pb, Cu and U were conducted in the laboratory. The in situ Eh-pH and conductivity measurements, and analyses for major and minor elements of ground waters suggest that deep-lying chlorite-graphite schists containing the uranium mineralization are well protected from, or do not react rapidly with, ground water under present-day conditions, i.e. the schists of the Cahill Formation are a stable host for uranium mineralization at depth. In the vicinity of the Magela flood plain where the Cahill Formation and the permanent water table are close to the surface, some samples were found to contain high concentrations of sulphate, zinc, lead and iron. These same samples were characterized by low pH's in the pH range 3.0-4.0. The anomalies suggest weathering of sulphides associated with the mineralized Cahill Formation, where the schists are at shallow depths and in an oxidizing environment. The anomalies are not, however, necessarily indicative of zones of uranium enrichment in this formation.

100 **Grants and world uranium.** Wright, R.J. (Dept. of Energy, Washington, DC). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 22-35(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Grants uranium region is the premier uranium mining district of the world: the region has yielded the most uranium (113,400 metric tons $U_3O_8$), has the highest current rate of production (7,800 metric tons $U_3O_8$ in 1978), and has the largest published reserves (430,000 tons $U_3O_8$ at a forward cost up to $50 per lb). Most of the ore in Grants is in sandstone, as it is in the other main uranium districts of the United States. The United States deposits of this type have provided a model for exploration around the world. Most of the foreign sandstone deposits illustrate the familiar relationship of uranium ore with plant matter and fluvial channels. Some foregin deposits show the strong influence of structure. Others contain ore in black shaly facies and in aeolian sandstone. Both acid volcanics and granites appear to be likely sources of the uranium.

101 **Stratigraphic implications of uranium deposits.** Langford, F.F. (Univ. of Saskatchewan, Canada). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 36-39(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

One of the most consistent characteristics of economic uranium deposits is their restricted stratigraphic distribution. Uraninite deposited with direct igneous affiliation contains thorium, whereas chemical precipitates in sedimentary rocks are characterized by thorium-free primary uranium minerals with vanadium and selenium. In marine sediments, these minerals form low-grade disseminations; but in terrestrial sediments, chiefly fluvial sandstones, the concentration of uranium varies widely, with the high-grade portions constituting ore. Pitchblende vein deposits not only exhibit the same chemical characteristics as the Colorado-type sandstone deposits, but they have a stratigraphically consistent position at unconformities covered by fluvial sandstones. If deposits in such diverse situations have critical features in common, they are likely to have had many features of their origin in common. Thus, vein deposits in Saskatchewan and Australia may have analogues in areas that contain Colorado-type sandstone deposits. In New Mexico, the presence of continental sandstones with peneconformable uranium deposits should also indicate good prospecting ground for unconformity-type vein deposits. All unconformities within the periods of continental deposition ranging from Permian to Cretaceous should have uranium potential. Some situations, such as the onlap of the Abo Formation onto Precambrian basement in the Zuni Mountains, may be directly comparable to Saskatchewan deposition. However, uranium occurrences in the upper part of the Entrada Sandstone suggest that unconformities underlain by sedimentary rocks may also be exploration targets.

102 **Deposition and early hydrologic evolution of Westwater Canyon wet alluvial-fan system.** Galloway, W.E. (Univ. of Texas, Austin). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 59-69(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Westwater Canyon Member is one of several large, low-gradient alluvial fans that compose the Morrison Formation in the Four Corners area. Morrison fans were deposited by major laterally migrating streams entering a broad basin bounded by highlands to the west and south. The Westwater Canyon sand framework consists of a downfan succession of 1) proximal braided channel, 2) straight bed-load channel, 3) sinuous mixed-load channel, and 4) distributary mixed-load-channel sand bodies. Regional sand distribution and facies patterns are highly digitate and radiate from a point source located northwest of Gallup, New Mexico. Early ground-water flow evolution within the Westwater Canyon fan aquifer system can be inferred by analogy with Quaternary wet-fan deposits and by the interpreted paragenetic sequence of diagenetic features present. Syndepositional flow was controlled by the downfan hydrodynamic gradient and the high horizontal and vertical transmissivity of the sand-rich fan aquifer. Dissolution and transport of soluble humate would be likely in earliest ground water, which was abundant, fresh, and slightly alkaline. With increasing confinement of the aquifer below less permeable tuffaceous Brushy Basin deposits and release of soluble constituents from volcanic ash, flow patterns stabilized, and relatively more saline, uranium-rich ground water permeated the aquifer. Uranium mineralization occurred during this early postdepositional, semiconfined flow phase. Development of overlying Dakota swamps suggests a shallow water table indicative of regional dischare or stagnation. In either event, only limited downward flux of acidic water is recorded by local, bleached, kaolinized zones where the Westwater Canyon directly underlies the Dakota swamps. Subsequent ground-water flow phases have further obscured primary alteration patterns and caused local oxidation and redistribution of uranium.

103 **Organic geochemistry and uranium in Grants mineral belt.** Leventhal, J.S. (Geological Survey, Denver, CO). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 75-85(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Organic material is intimately associated with the primary uranium deposits of the Grants mineral belt. This organic material is now insoluble and nonvolatile, and most of it lacks cellular structure. The relationship of organic matter and uranium can be shown physically, chemically, and statistically. Pyrolysis-gas chromatography, mass spectrometry, and elemental analysis have been used to examine the organic matter from several ore deposits. The results show carbon-rich materials that have been severely degraded by radiation from uranium and daughter products. The organic material now resembles amorphous carbon, having lost most of its hydrogen and oxygen. From the uranium content and approximate age the radiation dose is calculatd to be $10^{11}$ rads. The radiation damage has also produced an interesting new carbon-isotope fractionation effect, by which the carbon associated with ore is enriched in carbon-13 ($C^{13}$) relative to the non-ore carbon. From model experiments and laboratory work on samples from the Grants district, the following hypotheses are made: first, the soluble organic matter (of unknown origin) coated or precipitated on the

mineral grains; subsequently, the uranium (probably as uranyl cation or carbonate anio complex) was concentrated in and on this organic matter by ion exchange and chelation with functional groups. This cycle of organic coating and uranium concentration could have been episodic or continuous but must have lasted at least $10^6$ years, based on calculations using assumed porosity, permeability, hydraulic gradient, uranium content of water, and organic concentration factors. Finally, after $10^8$ years, the radiation damage has created an amorphous carbon material that is deficient in hydrogen and oxygen; this material helps to protect the ore from mobilization because it is chemically inert.

104 **Origin and significance of organic matter in uranium deposits of Morrison Formation, San Juan Basin, New Mexico.** Squyres, J.B. (Amoco Minerals Co., Englewood, CO). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 86-97(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Primary uranium orebodies in the Morrison Formation of the San Juan Basin, New Mexico, consist of submicroscopic coffinite in a matrix of dark-colored structureless carbonaceous matter that impregnates and partially replaces the Morrison sandstones. Recognizable carbonized plant fragments are also abundant both in and near ore. The orebodies are elongated, lenticular or tabular masses; they are oriented parallel to paleochannel systems in the host rocks. Accessory minerals in the orebodies are crudely zoned. The surrounding sediments are pervasively altered, chiefly by destruction of iron oxides and reprecipitation of pyrite. Stratigraphic, structural, and radiometric evidence indicates that the orebodies are approximately the same age as their host rocks. The carbonaceous matrix of the ore has been tentatively identified as degraded humate. Geologic evidence supports this conclusion and suggests a genetic model for the origin and geology of the orebodies. According to this model, humic acids were leached from buried plant debris by ground water, during or shorly after Morrison sedimentation. The acids migrated with the ground water and eventually consolidated into streamlined, interstitial humate masses. Uranium in the ground water was chelated by the humates and subsequently reduced. Molybdenum and other metals were precipitated at the humate boundaries by hydrogen sulfide. Organic matter and reduced sulfur species were both involved in alteration of the host rocks. Post-ore processes have modified the orebodies and host rocks.

105 **Effects of ground-water flow on the origin of Colorado Plateau-type uranium deposits.** Ethridge, F.G. (Colorado State Univ., Ft. Collins); Ortiz, N.V.; Granger, H.C.; Ferentchak, J.A.; Sunada, D.K. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 98-106(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The precipitation of humic acid at the interface between a humic-acid solution and an aluminum-potassium-sulfate solution was studied under controlled laboratory conditions to gain insight into the deposition of Colorado Plateau-type uranium deposits. During these experimental runs, distinct bands of precipitate formed both parallel and perpendicular to the flow path at the interface between solutions. The precipitate filled pore space, reducing hydraulic conductivity, while the thickness of the deposits increased with time. When the flow rate of humic acid was increased, the precipitate was dissoled back into solution and reprecipitated at a new interface. However, when the flow rate was decreased, the original deposit remained, and a new zone of precipitate formed. Under experimental conditions characterized by multiple-porous-media layers, the precipitate was more concentrated in layers having greater permeability. Baffles used to simulate mudstone layers caused significant changes in the flow configuration and thus in the orientation and location of the precipitate bands. Density differences between the two solutions appear to have had little effect on the concentration of the deposits, and significant effects due to diffusion were not observed. Precipitate patterns in models simulating river deposits closely resemble actual patterns of some tabular orebodies of the Colorado Plateau. These experiments provided a visual record of the shape and distribution of deposits resulting from fluid-flow patterns and reactions between two solutions. This information should prove useful in predicting the shape and distribution of sandstone uranium deposits and the relations between these deposits and ground-water flow patterns.

106 **Dissolution and authigenesis of feldspars.** Austin, S.R. (Bendix Field Engineering Corp., Grand Junction, CO). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 107-115(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Feldspars constitute about 25 percent of the host sandstones of the Morrison Formation, Grants uranium region. Most range from fresh to slightly altered, but partial dissolution of sanidine is common, leaving a thin shell conforming to the detrital grain surface. During weathering, transport, or-more probably-early diagenesis, potassium probably replaces sodium in an outer layer of the sanidine grain, converting it to low microcline, the least soluble potassium feldspar at low temperatures. During later diagenesis, pressure solution penetrates the microcline layer at grain contacts, and the interior sanidine is dissolved, leaving a thin shell that conforms closely to the grain surface. The shell may be empty, or it may contain either sliver-like or castellated remnants or nearly complete grains. Solution of plagioclase conforms more nearly to crystallographic directions, sometimes leaving riddled grains. Authigenic feldspar overgrowths occur mostly later than organic material containing uranium. this feldspar also occurs in baren zones, sometimes as minute crystals within sanidine shells. Calcite and other minerals fill cavities left by the dissolution of feldspars but do not commonly replace the feldspars in the classic sense.

107 **Depositional environments as ore controls in salt wash member, Morrison Formation (Upper Jurassic), Carrizo Mountains area, Arizona and New Mexico.** Huffman, A.C. Jr. (Geological Survey, Denver, CO); Kirk, A.R.; Corken, R.J. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 122-130(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Uranium deposits in the Salt Wash Member of the Morrison Formation in the Carrizo Mountains area are closely related to depositional facies. In the vicinity of the Eastside mines, southeastern Carrizo Mountains, the Salt Wash Member consists of a lower part, 30 to 50 ft (9 to 15 m) thick, and an upper part, 180 to 200 ft (55 to 60 m) thick, which is further divisible into two stratigraphic units. The lower part or distal-fan facies is predominantly mudstone and silty sandstone interpreted as overbank and partially abandoned channel-fill deposits. This part also contains a few large, lenticular, channel sandstones deposited by braided and possibly meandering streams. Uranium deposits are uncommon in the lower part. The upper part or midfan facies of the Salt Wash contains a much greater percentage of braided-stream-deposited channel sandstones, many of which coalesce to form prominent continuous ledges. Fine-grained low-energy deposits are limited in extent; they are commonly less than 600 ft (200 m) long, 60 ft (20 m) wide, and 6 ft (2 m) thick, with a lenticular cross section and a scoured base. These deposits consist of interbedded mudstones, claystones, and sandstones and are interpreted as abandoned and partially abandoned channel fills. Scouring of these beds resulted in clay-clast conglomerates that were incorporated as lag deposits in the bases of overlying channel sandstones. Detrital organic debris is present in some channel-lag deposits and in some of the bedded mudstones and parallel-bedded sandstones. Uranium deposits in the Carrizo Mountains area are associated with channel-sandstone systems that have scoured into abandoned and partially abandoned channel-fill deposits in the lower midfan facies of the Salt Wash.

108 **Geology of pre-Dakota uranium geochemical cell, sec. 13, T. 16 N., R. 17 W., Church Rock area, McKinley County.** Peterson, R.J. (Teton Exploration Drilling Co., Inc., Albuquerque, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 131-138(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Exploration drilling on sec. 13, T. 16 N., R. 17 W., McKinley County, New Mexico, has defined uranium deposits within the Westwater Canyon Member of the Morrison Formation (Jurassic).

Elongate, tabular, redistributed deposits were formed peripherally along the zones of highest transmissivity of the northeast-trending Westwater Canyon fluvial system by a Jurassic-Cretaceous geochemical cell. Strongly reducing conditions, which existed locally in the channel-margin areas owing to the presence of organic materials, were the primary ore control. Evidence that this major redistribution process took place in pre-Dakota time is the bleaching of the Westwater Canyon Sandstone by Dakota swamps is superimposed on older oxidation, and the primary mineralization above the Jurassic-Cretaceous water table was not affected by the geochemical-cell redistribution process.

109 **Geology of Crownpoint Sec. 29 uranium deposit, McKinley County.** Wentworth, D.W. (Conoco Inc., Albuquerque, NM); Porter, D.A.; Jensen, H.N. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 139-144(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Crownpoint Sec. 29 deposit, located in the west-central part of the Grants mineral belt, represents a relatively recent uranium discovery in the Westwater Canyon Member (Jurassic) of the Morrison Formation. This deposit, estimated as containing up to 10 million pounds of uranium oxide, occurs in four vertically separate sandstone units. The average depth of the ore mineralization is approximately 2,000 ft (610 m) below the ground surface. Present-day structure of the Crownpoint Sec. 29 area is relatively simple and consists of gentle north-northeast-dipping strata with no known faulting. This deposit is located in an east-southeast-trending Westwater Canyon depocenter, whose course is believed to have been influenced by subtle Jurassic structure, which was penecontemporaneous with sedimentation. The deposit has been delineated by drilling on 200-ft (60-m) centers, involving approximately 348 holes and is awaiting shaft sinking and mine development.

110 **Geology of eastern Smith Lake ore trend, Grants mineral belt.** Ristorcelli, S.J. (Western Nuclear, Inc., Albuquerque, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 145-152(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The sandstones in the Brushy Basin Member of the Morrison Formation (Jurassic) are the ore-bearing horizons of the eastern Smith Lake area. The Brushy Basin Member in this district consists of three sandstones with interbedded mudstones. Only the lower two sandstones contain ore. The sandstones are fine to coarse grained, well rounded, and arkosic, representing continental stream sediments. The lower sandstone contains rollfront ore. The redox interface is laterally extensive and well defined, extending at least 7 mi (11 km) west of the Bluewater fault zone. The ore generally occurs at the redox boundary but occasionally will be up to 1500 ft (450 m) updip. Limonitic alteration, where present, is downdip from the hematitic zone and is 100-1,500 ft (30 to 450 m) wide. The middle sandstone contains both trend ore and roll-front ore. The trend ore occurs downdip from the redox front in unoxidized ground. The redox front in the middle sand is also laterally extensive but displays a wedge shape, rather than a C shape. The clay assemblages of the two types of ore are different: the trend ore occurs in sands with the pore spaces filled with kaolinite; the rollfront ore is associated with altered illite-montmorillonite as grain coatings. Hematitic alteration is asociated with the latter. A second stage of kaolinite coats the illite-montmorillonite. Two periods of mineralization are suggested, but no absolute dates are known. The trend ore is the oldest (Jurassic) and is similar to the ore found in unoxidized ground elsewhere in the Grants region. The rollfront ore could be Laramide or post-Laramide because of its association with local Laramide structures.

111 **Depositional environment of Brushy Basin Member, Morrison Formation, in Gulf Mariano Lake mine, McKinley County.** Jenkins, J.T. Jr.; Cunningham, S.B. (Gulf Research and Development Co., Houston, TX). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 153-161(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Mariano Lake mine, McKinley County, New Mexico, is developed in the lower portion of the Brushy Basin Member of the Morrison Formation (Upper Jurassic). The sandstones typically are arkosic to subarkosic, moderately to poorly sorted, medium to coarse grained, subrounded, carbonaceous, and silica cemented. Early emplacement of uranium minerals occurred along geochemical boundaries in a roll-front geometry. In the area of the Mariano mine, the Brushy Basin member was deposited as a series of stacked, lenticular-shaped sand bodies interfingering with bentonitic mudstones. Petrologic and sedimentologic data allow the interval to be divided into four depositional facies. These facies represent inchannel and flood-basin deposits of a braided-stream complex with characteristics of the present-day Platte River and Bijou Creek.

112 **Mineralogical variations across Mariano Lake roll-type uranium deposits, McKinley County.** Sachdev, S.C. (Gulf Research and Development Co., Pittsburgh, PA). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 162-171(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Mineralogy of core samples from the Mariano orebody was determined. The data obtained were used to develop exploration tools for roll-type uranium deposits. Preliminary interpretations of the physical and chemical conditions of ore deposition were made on the basis of paragenetic relationships. The host sandstones occur between the bentonitic rock units and contain scattered intercalations of detrital montmorillonitic material in the form of clay galls, stringers, and lenses derived from these bentonites. Authigenic clay minerals identified in the host rocks include cellular montmorillonite, platy chlorite, and pseudohexagonal books of kaolinite. The cellular montmorillonite is concentrated in the oxidized zone and appears to have formed prior to ore deposition. Authigenic chlorite is most abundant in the ore zone and has formed at the expense of cellular montmorillonite; its formation is interpreted as being related to the ore-forming processes. Kaolinite in sandstones is the last clay mineral to form and is enriched in the reduced zone. Calcite, considered typical of such deposits, is not found in this orebody. Iron-titanium oxides and their alteration products are the most abundant heavy-mineral species in the host rocks. In addition to anatase and rutile, the alteration products include hematite in the oxidized zone and pyrite in the ore and reduced zones. Carbonaceous material introudced later into the potential ore zone appears to have been responsible for the decomposition of Fe-Ti oxides and the formation of pyrite. The paragenetic relationship indicates oxidation of pyrite by mineralizing solutions, resulting in reduction and subsequent deposition of uranium. The positive correlation between organic carbon and uranium suggests that carbonaceous material also acted as a reductant for uranium.

113 **Mineralogy and geochemistry of Mariano Lake uranium deposit, Smith Lake district.** Place, J. (Gulf Oil Corp., Casper, WY); Della Valle, R.S.; Brookins, D.G. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 172-184(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Mariano Lake uranium deposit is located on the west side of the Smith Lake district in the Grants mineral belt. Mineralization is restricted to a basal arkosic sandstone of the Brushy Basin Member of the Morrison Formation (Upper Jrassic). This sandstone is equivalent to the Poison Canyon sandstone of the Ambrosia Lake district and contains a series of paleochannels that have been mineralized. The ore displays a roll-type geometry and is located at an iron-sulfur redox interface. The deposit is chemically different from other deposits of the grants mineral belt. It is characterized by low total carbon dioxide, calcium, molybdenum, and selenium, whereas sulfur and vanadium are enriched. Arsenic and zinc exhibit regular zoning patterns across the deposit. The deposit contains an ubiquitous assemblage of pyrite, kaolinite, chlorite, illite, and illite-montmorillonite associated with vanadiferous ore mixed with organic carbon. No primary uranium minerals have been identified. Gypsum (variety selenite) is present, but calcite is absent. The age of mineralization is unknown. The ore has been remobilized, perhaps more than once, and mineralization may have occurred during mid-Cretaceous, Laramide, or post-Laramide time. Based on existing data, polygenetic models are as reasonable as a single stage of remobilization.

114 **Heavy-mineral criteria for subsurface uranium exploration, San Juan Basin, New Mexico.** Rhett, D.W. (Phillips Petroleum Co., Bartlesville, OK). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 202-207(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

In Phillips Petroleum Company's Nose Rock deposit, uranium occurs in a series of roll-front deposits in now largely reduced rock. Mineralogical data support geological evidence that the oxidizing ground-water regime that prevailed during active migration of the roll fronts was replaced by a reducing ground-water regime. This reducing event halted roll-front migration and generally obliterated macroscopic evidence of oxidation. Diagenetic heavy-mineral assemblages have survived the reducing event and reflect the geochemical environment in which they formed. Consequently, diagnostic heavy-mineral assemblages can be used to identify geochemical zones associated with roll-front mineralization in reduced ground. A field trial based on the heavy-mineral composition of drill cuttings demonstrated that mineralogical criteria can provide a reliable means of recognizing stratigraphic horizons that were traversed by roll-front systems.

115 **Petrology of Westwater Canyon member, Morrison Formation, East Chaco Canyon drilling project, New Mexico-comparison with Grants mineral belt.** Hicks, R.T.; Lowry, R.M.; Della Valle, R.S.; Brookins, D.G. (Univ. of New Meixco, Albuquerque). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 208-214(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The results of this report are based on 47 samples of Westwater Canyon Sandstone, Morrison Formation (Upper Jurassic). The 250 to 350 ft (75 to 100-m) thick Westwater Canyon Member is 80 percent fine- to medium-grained arkosic sandstone and 20 percent interbedded red and green mudstones. Nine zones of low-grade uranium mineralization were intercepted by five drill holes. The alteration of Westwater Canyon sandstones in the East Chaco Canyon project area is similar to the alteration of sandstones near ore deposits in the Grants mineral belt. Magnetite grains located in and near mineralization display more severe dissolution than do grains far removed from mineralization. Typically, clay minerals replace feldspar along cleavages. A widely observed alteration feature is the dissolution of feldspar grain centers, leaving a thin shell of albite. Authigenic hematite occurs in feldspar cleavages and in the matrix of some detrital mudstone clasts. The authigenic clay mineralogy of the 47 samples does not vary significantly. Nests of authigenic kaolinite make up less than 50 percent of the -2 micron fraction. Grain coatings of authigenic chlorite have an edge-to-face or rosette habit and account for about one-third of the authigenic clay minerals. Mixed-layer illite-montmorillonite also forms grain coatings. Preliminary chemical analyses of the samples indicate a low uranium content in the whole-rock samples (about 2 ppM).

116 **Geology and recognition of a relict uranium deposit in Sec. 28, T. 14 N., R. 10 W., Southwest Ambrosia Lake Area, McKinley County.** Smith, D.A.; Peterson, R.J. (Teton Exploration Drilling Co., Inc., Albuquerque, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 215-225(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Sandstone uranium deposits in the Morrison Formation (Jurassic) within the Ambrosia Lake district, New Mexico, can be broadly classified into four types, based on their geometry and genesis: primary (trend), redistributed fracture-controlled (stack), redistributed geochemical-cell-controlled, and relict (remnant) deposits. Combinations of these deposits can be found within individual orebodies. Many similarities exist among these types of deposits, suggesting the same mechanisms and controls for the origin of the deposits. Probably the most important distinguishing control is the position of the deposits relative to the furthest advance of a pre-Dakota geochemical cell within the Morrison strata. Redistribution of both uranium and humate material occurred as oxidizing conditions migrated through the fluvial sediments. The migration of the oxidizing ground water was largely controlled by the differences in transmissivity developed within the fluvial facies of the host rock. The Sec. 28 uranium deposit, southwest of the major deposits of the Ambrosia Lake district, is here described as a relict uranium deposit. Preservation of the Sec. 28 relict deposit probably was aided by 1) the relatively insoluble character of intermixed uranium and organic matter, 2) lower ground-water transmissivity associated with a stratigraphic pinch-out of the mineralized upper Westwater Canyon, and 3) the influence a set of bounding faults has exhibited on the ground-water flow pattern since Laramide time. Iron-redox, isopach, and sandstone/mudstone trends observed in the Morrison strata in sec. 28 allow the development of a genetic model for relict orebodies within the Ambrosia Lake district.

117 **Redistributed orebodies of Poison Canyon, Sec. 18 and 19, T. 13 N., R. 9 W., McKinley County.** Tessendorf, T.N. (Reserve Oil and Minerals Corp., Grants, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 226-229(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Since the early 1950's, the Poison Canyon mine has been considered a classic example of uranium geology. Owing to present economic condtions, a close examination of the redistributed mineralization is taking place. Because of the evolution of the structure and geomorphology of Poison Canyon, the primary mineralization went through further oxidation and reduction. Enriched solutions of uranium migrated downdip through permeable sands. These solutions were controlled by north-trending fracture patterns, with some vertical movement along major faults. The uranium collected in structural and lithological traps, forming amoeba-like orebodies with the higher grade mineralization located in the fractures. First-generation redistributed ore is primarily coffinite. Forming later is second-generation redistributed ore, which is mainly tyuyamunite. The latter formed from further oxidation and redistribution of the primary and first-generation mineralization, combined with an increasing nearness to surface. The authigenic minerals in the redistributed mineralization are found in carbon-deficient sands. The redistributed minerals are locally associated with pascoite, although this mineral is rare. The radiometric equilibrium of the primary minerals differs from that of the redistributed minerals. The uranium has been leached from the primary minerals making chemical values less than radiometric values. The redistributed minerals are chemically greater than radiometric, producing a favorable equilibrium. The percent extraction in the mill process is greater for the redistributed ore than for the primary ore. The paragenetic position of the different minerals has a direct bearing on these observations.

118 **Geology and ore deposits of Johnny M mine, Ambrosia Lake District.** Falkowski, S.K. (Shell Oil Co., Houston, TX). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 230-239(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Johnny M mine is one of very few mines in the Ambrosia Lake district with uranium ore in two members of the Morrison Formation (Jurassic); these members are the Westwater Canyon Sandstone and the Brushy Basin Shale. The Westwater Canyon ore is contained in the two upper sandstone units of the member, and the Brushy Basin ore is contained in the Poison Canyon sandstone (informal usage). The sedimentary features and structures in the Westwater Canyon sandstones indicate that the sediments were deposited by a system of aggrading braided streams, possibly at the distal end of coalescing alluvial fans. The Poison Canyon sandstone was probably the result of deposition in a complex environment of meandering and braided streams. Paleocurrent-direction indicators, such as fossilized-log orientation, foreset azimuths, and the axes of crossbeds and channel scours, suggest that the local palostream flow was to the east and southeast. The uranium mineralization is closely associated with 1) local accumulations of carbonaceous (humate) matter derived from the decay of organic material and 2) paleostream channels preserved in the rocks. The ore elements were derived from the leaching of volcanic air-fall tuffs and ash, which were introduced into the fluvial system during volcanic activity in the western United States. The mobile ore-element ions were reduce and concentrated by humic acids and bacteria present in the fluvial system and ultimately remobilized into the forms present today. The uranium is thus envisioned as forming either essen-

tially on the surface as the sediments were being deposited or at very shallow depth.

119 **Scanning-electron-microscope investigation of paragenesis of uranium deposits, Mount Taylor and elsewhere, Grants Mineral Belt.** Riese, W.C. (Gulf Mineral Resources Co., Albuquerque, NM); Brookins, D.G.; Della Valle, R.S. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 244-251(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Scanning-electron-microscope study of authigenic minerals in the Westwater Canyon Member of the Morrison Formation (Upper Jurassic) indicates that compositional variations exist within and adjacent to sandstone-type uranium deposits. Montmorillonite is the dominant clay mineral downdip of the orebody; chlorite is enriched in the ore zones, and kaolinite and altered montmorillonite are enriched in ground updip of the ore. The data also suggest that clay minerals, not pyrite or hematite, may locally be the iron-bearing species of importance. While it is not possible to positively identify organic materials in SEM (scanning-electron microscope) photomicrographs, materials deduced to be organic in nature postdate the beginning of authigenic clay formation. This implies that these materials may be carriers of uranium in the ground-water system from which the ore deposits precipitated. Identification of patterns of clay-mineral alteration and the role that organic materials might play as transporting media could significantly alter exploration techniques. These patterns may be especially useful tools in areas where the orebodies are known to be removed from the iron-species redox interface.

120 **Bernabe Montano uranium deposit, Sandoval County.** Kozusko, R.G. (Conoco Minerals Co., Spokane, WA); Saucier, A.E. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 262-268(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Uranium mineralization was discovered on the Bernabe Montano Grant early in 1971. This old land grant, which is part of the Laguna Indian Reservation, is approximately 25 mile northwest of Albuquerque, New Mexico. About 2,000 holes have been drilled on this property to date, and an ore reserve of 10 to 20 million lbs of uranium oxide has been delineated in the Westwater Canyon Member of the Morrison Formation. The mineralization consists of multiple, stacked blankets of mineralized humate which appear to be localized in an area of slightly thicker and more laterally continuous sandstones. The blankets occur along a relatively straight mineral trend about a half mile wide and several miles in length. Holes drilled on-trend usually encounter gamma anomalies, whereas holes drilled off-trend are barren. The uranium is believed to have been carried through the Westwater Canyon Member by ground water that followed the palochannel systems shortly after burial in Late Jurassic time. This discovery once again confirms the trend-ore concept, and it probably represents the present eastern economic limit of the Grants mineral belt. The orebody is unusual because it occurs in a structurally deformed area called the Rio Puerco fault zone. The mineralization, which does not conform to a roll-front model, represents an important addition to the ore reserves of the Grants uranium region.

121 **Comparison of braided-stream depositional environment and uranium deposits at Saint Anthony underground mine.** Baird, C.W. (UNC Mining and Milling, Seboyeta, NM); Martin, K.W.; Lowry, R.M. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 292-298(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

United Nuclear's Saint Anthony mine, located in the Laguna district, produces uranium ore from the Jackpile sandstone unit of the Morrison Formation. The Jackpile sediments were deposited in a fluvial environment characterized by aridity, gentle slope, distant source area, and limited flow volume. Resultant stratigraphy consists of an intricate assemblage of trough and tabular cross-stratification grading to near massive bedding at some locations. Interbedded with the Jackpile sands are green mudstones and siltstones that commonly display irregular thicknesses of less than 2 ft and that are laterally discontinuous. Major penecontemporaneous and postdepositional alteration of originally deposited sands, silts, and clays includes: 1) infiltration and filling of interstices by kaolinitic clays; 2) mobilization and relocation of organic carbonaceous material; and 3) geochemical alteration of mineral constituents and fixation of uranium ions in organic carbonaceous material. Mineralized zones of economic volume display a spatial relationship to bedding features indicative of loosely packed sand deposited in dune and trough foresets. This relationship indicates possible permeability control by initial stratigraphy upon the flow of mineralizing solutions. Additionally, the low-energy foreset environment facilitates the accumulation of low-specific-gravity carbonaceous material necessary for interaction with mineralizing solutions. Large volumes of loosely packed foreset sands accumulate in transverse bars in braided-stream environments. These structures have a great potential for conducting large volumes of mineralizing fluids and hosting economic quantities of uranium ore.

122 **Geology and characteristics of uranium mineralzation in Morrison Formation at Dennison-Bunn Claim, Sandoval County.** Ridgley, J.L. (Geological Survey, Denver, CO). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 299-303(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Uranium at the Dennison-Bunn claim, south of Cuba, New Mexico, and along the east margin of the San Juan Basin, occurs in fluvial channel sandstone of the Westwater Canyon Member of the Morrison Formation (Upper Jurassic). An anomalously radioactive zone is bounded on the north and south by buff and orange sandstone of variable width. Within the anomalous zone, uranium is concentrated along the margins of smaller tongues of oxidized rock in a configuration similar to that found in roll-type uranium deposits. The uranium content in the mineralized rock ranges from 0.002 to 0.07 percent $U_3O_8$. The uranium is believed to have originated within the Westwater Canyon Member or to have been derived from the overlying Brushy Basin Member. Based on observed outcrop relations, two hypotheses are proposed to explain the origin of the mineralization: the anomalous zone represents 1) an original roll-type uranium deposit, or 2) an original tabular deposit that has undergone subsequent oxidation with remobilization and redeposition of uranium around the margins of smaller tongues of oxidized rock. Similarities between the mineralization at the Dennison-Bunn claim and that in roll-type uranium deposits near San Ysidro suggest that a roll-type origin is the most probable for this deposit. Similar deposits unaffected by surface oxidation may be present in the subsurface along the east side of the basin.

123 **Western Australian conference 1979. Proceedings of the Australian Institute of Mining and Metallurgy conference held in Perth, Australia, August 12-17, 1979.** Melbourne, Australia; Australasian Institute of Mining and Metallurgy (1979). vp. (CONF-7908149—).

From Australian Institute of Mining and Metallurgy conference; Perth, Australia (12 Aug 1979).

Separate abstract have been prepared for individual items within scope for inclusion in the energy Data Base.

124 **Australia's mineral energy resources: assessment and potential. Proceedings of a seminar held in Sydney, 1978.** Philip, G.M.; Williams, K.L. (eds.). Sydney, Australia; Earth Resources Foundation, Sydney University (1978). vp. (CONF-7805204—).

From National seminar on Australia's mineral energy resources; Sydney, Australia (22 May 1978).

Separate abstracts have been prepared for individual items within scope for inclusion in the Energy Data Base.

## 0502 Exploration

*REFER ALSO TO CITATION(S) 59, 65, 71, 101, 107, 108, 109, 110, 113,*

*114, 115, 117, 118, 119, 120, 121, 122, 152, 154, 1264*

125 **History of the evaluation and exploitation of a group of small uranium mines in Portugal.** Cameron, J. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Power and Reactors). pp 179-205 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

In the period 1945-1962 a multiple small-scale uranium mining project was successfully operated in Portugal by the Companhia Portuguesa de Radium Lda, the Urgeirica Mine and some 28 smaller mines produced ore between 1951 and 1962 and provided uranium concentrates for export under an agreement between the Portugal, the United Kingdom and the United States Governments. The uranium deposits occur in near-vertical fractures in the granites of the Beiras mostly having a NE-SW strike trend. The veins are the siliceous-pyrite-galena type with red jasper and black and white quartz gangue and much wall rock alternation and shearing. The primary uranium mineral is pitchblende and the secondary minerals tobernite and autunite occur in the near-surface zones. Of the 63 concessions controlled in 1945, the Urgeirica Mine, dating from the radium period, was by far the biggest, but by mid-1946, after a very rapid preliminary evaluation, it was concluded that a total "possible" ore reserve of 1080 tons $U_3O_8$ might exist in the concessions. On this basis an agreement was reached with the Portuguese Government for the production and export of between 120 and 150 t $U_3O_8$ per year for a twelve-year period up to the end of 1962, and for a maximum of 1325 t $U_3O_8$. Production commenced on a regular basis at the beginning of 1952 and the total production quota of 1325 t $U_3O_8$ was produced by 31 March 1962.

126 **Data management for evaluation of deposits at Nuclebras.** Da Vinha, C.A.G.; Garcia Guerra, P.A. (NUCLEBRAS, Rio de Janeiro (Brazil)). pp 207-229 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980). (In Spanish)

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

The large volume of data generated in any deposit evaluation work based on information obtained from intensive drilling operations and produced by different types of equipment involved in prospecting calls for the establishment and use of standardized and unified systems of data collection. Thus, standardization of data collection and electronic data processing must be ensured if the management of such data is to be viable, i.e. effective from the technical and economic points of view. These two considerations form the basis of the Nuclebras data management system, in which essential data are collected and processed by means of sub-systems called Catalogue of Samples, Drilling Report and Application Programmes, thus providing the basis for conventional statistical and geostatistical evaluations. It should also be noted that new data to be generated at the subsequent stages of planning and mining control will be added to this core, so that it has to be sufficiently flexible and generic to be used in the long term for a wide variety of purposes.

127 **Evaluation of uranium resources in Antarctica.** Zeller, E.J.; Dreschhoff, G.A.M. (Kansas Univ., Lawrence (USA). Space Technology Labs.). pp 381-390 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

The continent of Antarctica comprises roughly nine per cent of the total land surface of the earth and is the only large land area that has been left almost totally unexplored for uranium resources. In 1976 the first systematic uranium resource evaluation, entitled Antarctica International Radiometric Survey, was started as a part of the US Antarctic Research Program. This project was staffed jointly by scientists from the University of Kansas and the Bundesanstalt fuer Geowissenschaften und Rohstoffe of the Federal Republic of Germany. The survey has continued for three antarctic field seasons and an extension of operations for the next four years has been approved. Two areas in the Transantarctic Mountains and one part of Marie Byrd Land have been surveyed by airborne gamma-ray spectrometric methods. The work that has been conducted demonstrates clearly that radiometric surveys can be performed successfully under the rigorous climatic conditions in Antarctica, and that significant and reproducible data can be obtained. So far no substantial concentrations of uranium have been detected but deposits of thorium minerals have been found.

128 **Estimation of the uranium potential of Finnish bedrock.** Kauranne, L.K. (Geologinen Tutkimuslaitos, Espoo (Finland)). pp 391-404 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

Only about 3% of the bedrock in Finland (337,000 $km^2$) is exposed; the rest is covered by transported glacial or glaciofluvial drift. About 10% of the drift is covered by lakes and 30% by peat land. The thickness of the drift averages 7 m. The bedrock is composed of Archean and Proterozoic formations, almost all of which were metamorphosed in the Precambrian era. Uranium occurs commonly in refractory minerals but also as uraninite and its secondary minerals in a wide variety of host rocks. The known uranium deposits are associated with quartzites and conglomerates, carbonatites, pegmatites, albitites and shear zones in different rock types. The first stage of uranium exploration consists of reconnaissance survey by airborne radiometrics and/or lake sediment geochemistry. The follow-up stage comprises car-borne scintillometry, terrain geophysics, detail geochemistry and diamond drilling. About US $700,000 are spent annually on uranium exploration. The four best occurrences might produce a total of 2700 t U at a cost of US $80-130/kg U. By 1985 Finland will be needing 2130 t natural uranium for its four power plants.

129 **Uranium potential of Greenland - A geological analysis of favourability.** Nielsen, B.L. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). pp 407-423 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

The potential for uranium deposits in Greenland is estimated on the basis of the following criteria: (1) the land areas, not covered by inland ice are 340,000 $km^2$, and geologically extremely well exposed; (2) the geological history ranges from the early Archaean to the Quaternary, and a wide range of geological environments and lithologies are present; (3) the level of geological information is generally of a high quality, but the information is heterogeneous; (4) uranium exploration up to the present is mainly of a reconnaissance nature and it has only covered a part of Greenland; (5) only one major uranium deposit is at present known. It is concluded that the area with the highest potential is found in south Greenland and encompasses the early to middle Proterozoic mobile belt and the middle Proterozoic suite of Gardar alkaline igneous plutons. The high favourability of these units is supported by data from recent exploration work in the area as well as by radiometric data of an earlier date. In particular Ketilidian metasedimentary units, and the Ketilidian and post-Ketilidian country rocks of some of the Gardar complexes appear favourable. In view of the limited exploration work carried out, the early Proterozoic mobile belt in north central Greenland as well as the Proterozoic crystalline basement and the overlying suprastrata of the Thule Group in north-west Greenland

are classified as being of medium favourability. Further exploration is required within these areas.

130 **Research on interactive genetic-geological models to evaluate favourability for undiscovered uranium resources.** Finch, W.I.; Granger, H.C.; Lupe, R. (Geological Survey, Denver, CO (USA)); McCammon, R.B. (Geological Survey, Reston, VA (USA)). pp 447-461 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

Current methods of evaluating favourability for undiscovered uranium resources are unduly subjective, quite possibly inconsistent and, as a consequence, of questionable reliability. This research is aimed at reducing the subjectivity and increasing the reliability by designing an improved method that depends largely on geological data and their statistical frequency of occurrence. This progress report outlines a genetic approach to modelling the geological factors that controlled uranium mineralization in order to evaluate the favourability for the occurrence of undiscovered uranium deposits of the type modelled. A genetic model is constructed from all the factors that describe the processes, in chronological sequence, that formed uranium deposits thought to have a common origin. The field and laboratory evidence for the processes constitute a geologic-occurrence base that parallels the chronological sequence of events. The genetic model and the geologic-occurrence base are portrayed as two columns of an interactive matrix called the "genetic-geologic model". For each column, eight chronological stages are used to describe the overall formation of the uranium deposits. These stages consist of (1) precursor processes; (2) host-rock formation; (3) preparation of host-rock; (4) uranium-source development; (5) transport of uranium; (6) primary uranium deposition; (7) post-deposition modification; and (8) preservation. To apply the genetic-geological model to evaluate favourability, a question is posed that determines the presence or absence of each attribute listed under the geologic-occurrence base. By building a logic circuit of the attributes according to either their essential or non-essential nature, the resultant match between a well-documented control area and the test area may be determined. The degree of match is a measure of favourability for uranium occurrence as hypothesized in the genetic model.

131 **Experience with the track etch method for uranium exploration in Northern Australia.** Pedersen, C.P.; Dunbier, J. (Noranda Australia Ltd., Melbourne); Gingrich, J.E. (Terradex Corp., Walnut Creek, CA (USA)). pp 351-356 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Track Etch technique for uranium exploration is a radon detection system which has been found to be helpful in exploring for 'hidden' uranium ore bodies. These 'hidden' bodies have little or no surface expression that can be detected with the usually employed airborne or ground radiometric detection methods. Radon from these 'hidden' bodies can migrate to the surface where it can be detected with Track Etch detectors and it can thus provide a clue which helps in discovering ore bodies which may be located at significant depths. A test of the Track Etch method was conducted in the Alligator Rivers Uranium Field in 1972 by Noranda in a uranium prospect area located 7km east-northeast of the Koongarra deposit near the base of the southeast escarpment of the Mt. Brockman outlier. The Track Etch readings measured a background radon level in the area of 7.3 T/mm$^2$ with a peak value of 702 T/mm$^2$ or almost 100 times background. The Track Etch technique, in this instance, successfully delineated the primary uranium mineralization buried by transported overburden. The radon anomaly covered a much larger surface area than the surface projection of the known primary mineralization. The strongest portion of the Track Etch anomaly appeared to be some 70m east of primary mineralization at a point where the shallowest primary mineralization was approximately 35m deep. The displacement of the anomaly peak from the centre of the primary mineralization is thought to be due to secondary uranium mineralization dispersal from the primary source caused by ground water movement or gaseous radon transport. In areas where dispersion of uranium daughter products occurred, spurious anomalies were detected remote from the primary uraniferous source. In most instances these surface anomalies (swampy black soils) could be identified by simultaneous measurements with both scintillometer and Track Etch methods.

132 **$^{234}U/^{238}U$ activity ratios in clay as a function of distance from primary ore.** Shirvington, P.J. (Australian Atomic Energy Commission, Coogee). pp 509-519 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Measurement of $^{234}U/^{238}U$ activity ratios in soil samples is proposed as a useful exploration tool for uranium in the Alligator Rivers Uranium Field. The technique would rapidly distinguish between dispersed uranium and traces of primary mineralization oxidised in place. It relies on the fractionation of $^{234}U$ and $^{238}U$ isotopes that occurs in weathered schists associated with uranium mineralization in the area. An enrichment in the $^{234}U$ isotope occurs by virtue of its lower solubility compared to $^{238}U$ in oxidising groundwaters. The extent of fractionation is measured $\alpha$-spectrometrically by comparing $^{234}U/^{238}U$ activity ratios in bulk clay with those in a dilute $HNO_3$ leachant. An equation is derived to give relative ages of uranium residence in clay and is applied to some of the 60 $^{234}U/^{238}U$ activity ratios obtained from 26 sample sites at the Nabarlek uranium orebody, in order to test the technique. Ages of approximately $10^5$y were indicated for uranium residence in clay near zones of primary mineralization and up to 30m into the dispersion tail, but ages decreased sharply beyond this point. Selective leaching experiments on weathered schists from Nabarlek and the Austatom uranium prospect indicated a chemical process was involved in the isotope fractionation.

133 **Genetic models and their impact on uranium exploration in the Athabasca sandstone basin, Saskatchewan, Canada.** Strnad, J.G. (Uranerz Exploration and Mining Ltd., Saskatoon, Saskatchewan, Canada). pp 631-638 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

While the Beaverlodge area of Northern Saskatchewan became an important uranium-producing district during the 1950s, the Athabasca sandstone basin, located in the immediate vicinity, was considered to be non-prospective in Canada's regional assessment. Twenty years later, with the introduction of the supergene model into the basin's exploration strategy, the favourability of the host-rock for uranium deposits was shown. However, in some instances the search for local targets was enriched by implementing non-supergene models. Most geologists originally favoured the Middle Proterozoic (sub-Helikian) unconformity as a unique ore-controlling feature. Later, the concept of Lower Proterozoic (Aphebian) syngenetic protore, as represented by graphite-bearing strata in Archaean proximity, was added. In the author's view the combination of these factors is productive only within specialized segments of Archaean-Lower Proterozoic (Archaean-Aphebian) contact zones.

134 **Present exploration status of the Lianshanguan uranium deposit, Northeast China.** Fei, Q. (Liaoning Exploration Team of Uranium Geology, The People's Republic of China); Shaokang, H. (Beijing Research Institute of Uranium Geology, The People's Republic of China). pp 655-661 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

During recent years surface radiometry has revealed a series of anomalies and uranium occurrences in the Lianshanguan region of Northeast China which are present in Proterozoic Formations. Several significant uranium occurrences were tested by trenching and core drilling which resulted in the discovery of the Lianshanguan uranium deposit in 1978. The ore bodies of economic significance are located at a depth of 38-250m. Potential reserves are 1000 tons of $U_3O_8$. The geological setting of the Lower Proterozoic Lianshanguan uranium deposit has a certain similarity to the Alligator Rivers Region, Northern Territory, Australia. However, the Lianshanguan deposit occurs in detrital formations (in the lower part of the Lower Proterozoic sequence), adjacent to a migmatitic zone; it is overlain by carbonate argillitic rocks. The discovery of the Lianshanguan deposit indicates a potential for further uranium discoveries in northeast China, where Proterozoic sequences are well developed. The Lianshanguan uranium deposit is located approximately 100km south of Shenyang at 40°59'N and 123°30'E.

135 **Comparison of exploration techniques in Saskatchewan and the Northern Territory.** Armstrong, C.W.; Brewster, N.E. (A.C.A. Howe International Ltd., Toronto, Canada). pp 733-742 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The unique physical properties of uranium, such as its radioactive decay series and its distinctive geochemical cycle involving marked mobility in the hexavalent state and fixation in reducing environments, have led to the development of a sophisticated range of direct exploration techniques. In addition more orthodox methods can be used both at an early state to outline a geological environment suitable for uranium mineralization and also in a later phase to trace host lithologies or structures which are outside the range of the more specific methods. With the recognition of the Alligator Rivers and Northern Saskatchewan areas as two of the world's major uranium districts with broadly similar regional geology and mineral deposits, it would seem a useful exercise to study how this wide range has been utilised in each area. It is beyond the scope of this paper to provide a detailed study of the application of every possible technique of whatever significance, or detailed case histories of the major discoveries. The object will be to trace the effect of developments in technology, instrumentation and geological understanding on each area and to determine the lessons to be learned for future exploration, within these two regions.

136 **Exploration in Grants uranium region since 1963.** Chenoweth, W.L. (Dept. of Energy, Grand Junction, CO); Holen, H.K. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 17-21(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Grants uranium region is the largest uranium area in the United States. As of January 1, 1979, the region accounted for 40 percent of the domestic uranium-ore production and contained 53 percent of the domestic reserves in the $30 per pound forwardcost category. Since 1963, the region has expanded to the north and east, primarily through the efforts of exploration programs of major oil companies. Exploration has been influenced by the availability of land rather than by the use of geologic models. During this period, nearly 65 million ft of surface drilling for uranium has been completed in the region. The average drilling depths have increased from approximately 200 ft to over 1,600 ft. The discovered reserves and the favorable geology for undiscovered potential resources are expected to maintain the position of the Grants uranium region as the nation's principal source of uranium for years to come.

137 **Exploration for uranium deposits, Grants mineral belt.** Fitch, D.C. (Ranchers Exploration and Development Corp., Albuquerque, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 40-51(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Uranium ore deposits in the Grants mineral belt, New Mexico, occur in fluvial sandstones in the Morrison Formation (Jurassic). Uranium mineralization is concentrated by a dark-gray to black substance that has been identified as humate, which is derived from decaying vegetation. Black ore is truncated by overlying sandstone in at least three ore deposits, documenting an early age for mineralization. Ore deposits in the Grants mineral belt vary greatly in size and shape, tend to occur in clusters, and often present difficult drill targets. Current exploration is largely a matter of drilling in stages to distinguish favorable from unfavorable ground on a wide spacing, to seek mineralization in favorable ground, and to conduct close-spaced drilling in mineralized areas. Criteria for favorability differ among exploration groups but generally include 1) presence of a host sandstone, 2) anomalous mineralization, 3) color of the host rock, 4) presence of carbonaceous matter, and 5) position of the area relative to mineralized trends. A description of the drilling sequence, from ore discovery to the development of a mine at the Johnny M deposit (in the east part of the Ambrosia Lake district), exemplifies the problem of predicting where orebodies may occur. A study of the drill data at the Johnny M indicates the uranium ore is not related to specific geologic features other than humate, which is commonly associated with coalified plant fragments in mudstone-rich parts of the host sandstone.

138 **Geochronologic studies in the Grants mineral belt.** Brookins, D.G. (Univ. of New Mexico, Albuquerque). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 52-58(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Geologic observation coupled with radiometric age dating can be used to assess ages of ore formation and, in some cases, ages of sedimentation in the Grants mineral belt. Rb-Sr studies indicate the earliest mineralization is trend ore at Ambrosia Lake and Smith Lake, dated at 139 +- 9.5 m.y. This date is similar to that for barren-rock montmorillonite from the Jackpile sandstone (Late Jurassic): 142 +- 14 m.y.; it may be used, with caution, to indicate the minimum age of sedimentation for the Morrison Formation. Geologic evidence indicates epigenetic rather than syngenetic ore formation. Barren-rock montmorillonites from Ambrosia Lake yield a poorly defined isochron of 132 +- 26 m.y. Early formed ore at the Jackpile-Paguate mine, Laguna district, was remobilized and reprecipitated at 113 +- 7 m.y. This date is older than the range of dates for the Dakota Formation (Cretaceous) and Mancos Shale. The 113 +- 7 m.y. mid-Cretaceous date for the Jackpile-Paguate ore is consistent with geologic evidence; geologic control suggests that other ore deposits are post-Late Jurassic but pre-Dakota Formation. Based on geologic evidence, mineralization in the Dakota Formation is thought to be very young. Laramide mineralization (60 to 70 m.y.) is evidenced by the presence of some stack ore. At least one uranium deposit, located partly in oxidized ground at the main redox front of the Grants mineral belt, may represent Tertiary mineralization; the clay-mineral Rb-Sr systematics of this deposit have been severely perturbed. Younger mineralization is indicated by U-Pb dates on uranophane (9 to 10 m.y.), and Pleistocene mineralization is noted for some ore. U-Pb dates of $U^{4+}$ -rich ore minerals cluster between 80 and 100 m.y., although some are as old as 140 to 150 m.y. K-Ar dates on clay minerals range from 49 to 138 m.y. The reasons for this scatter are not known, although loss of radiogenic $^{40}Ar$ due to burial is probable.

139 **Disconformities in Grants mineral belt and their relationship to uranium deposits.** Green, M.W. (Geological Survey, Denver, CO). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 70-74(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

At least five major, regionally extensive disconformities are present in sedimentary rocks of Triassic, Jurassic, and Cretaceous age in the Grants mineral belt. These disconformities, some of which have been known for many years, have proven useful in stratigraphic correlation and in differentiation of lithologically and genetically similar rocks in the mineral belt and elsewhere on the Colorado Plateau. Two of these disconformities, one in the lower part of the Morrison Formation and the pre-Dakota Sandstone disconformity, are believed to be related to the distribution of sandstone-type uranium deposits in the Morrison Formation (Jurassic) and in the immediately overlying Dakota Sandstone (Cretaceous). The Westwater Canyon Member and laterally equivalent beds in the Recapture Member of the Morrison Formation are separated from underlying Jurassic rocks by an intraformational disconformity which marks a major change in depositional environment, from predominantly sabkha with eolian dunes below the disconformity to mixed fluvial and lacustrine above the disconformity. This disconformity is economically significant because all of the large uranium deposits in the Grants mineral belt occur in first-cycle arkosic fluvial sandstone of the Morrison above the disconformity. The pre-Dakota disconformity is a well-known, predominantly southward-beveling regional disconformity that marks the lower boundary of the Dakota throughout the San Juan Basin and adjacent regions. In the western part of the mineral belt, relatively impermeable siltstone of the Brushy Basin Member of the Morrison Formation has been truncated by pre-Dakota erosion at this disconformity, and uranium-bearing ground waters from the Morrison have migrated into basal organic-rich sandstone of the Dakota to produce several small-to medium-sized uranium deposits.

140 **Geophysical experiments at Mariano Lake uranium orebody.** Thompson, D.T. (Gulf Research and Development Co., Pittsburgh, PA). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 185-194(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Several geophysical experiments were performed over the Mariano Lake orebody before mining. Surface self-potential methods, surface-to-hole induced-polarization methods, and reflection-seismic methods were used. These geophysical techniques provided data which relate to the conceptual model of this orebody. Currents generated in the productive formation by oxidation-reduction reactions do not generate measurable potential anomalies at the surface. Surface-to-hole induced-polarization measurements apparently can detect an oxidation-reduction front in the vicinity of an exploration borehole. Reflection-seismic techniques can provide information concening the paleostructure of the area.

141 **Uranium ore rolls in Westwater Canyon sandstone, San Juan Basin, New Mexico.** Clark, D.S. (Phillips Uranium Corp., Albuquerque, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 195-201(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Recent relatively deep uranium-exploration drilling in the Nose Rock area, San Juan Basin, McKinley County, New Mexico, has resulted in the discovery of previously unrecognized uranium ore rolls in gray, unoxidized Westwater Canyon Sandstone of the Morrison Formation. Both the Nose Rock ores and the primary Ambrosia Lake uranium ores were emplaced during the Late Jurassic-Early Cretaceous erosional interval under the same geologic conditions by the same geochemical-cell process. The red, altered interior ground resulting from the geochemical-cell process has been re-reduced by the subsequent entry of reductants into the formation. The original roll form of the Ambrosia Lake orebodies has been obscured and modified by redistribution related to the present-day active redox interface interweaving with the Ambrosia Lake ores.

142 **Anomalous orebody within the Ambrosia Lake trend at Sandstone Mine.** Foster, J.F.; Quintanar, R.J. (United Nuclear Corp., Grants, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 240-243(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Sandstone Mine contains an anomalous orebody that lacks the characteristic coloring and high gamma-ray expression typically associated with uranium ore in the Ambrosia Lake district. The orebody occurs at the downdip edge of a tongue of hematitic sand in the basal sand unit of the Westwater Canyon Member of the Morrison Formation. The orebody ranges from white to light gray in color. Preliminary analysis indicates the presence of uranophane ($Ca(UO_2)_2SiO_3(OH)_2.5H_2O$), evidently altered from coffinite, which is the predominant uranium mineral in the district. Equivalent $U_3O_8$ indicates that this orebody is relatively recent. Oxidizing meteoric water, which formed a geochemical cell, remobilized uranium minerals in preexisting trend orebodies and deposited the uranium downdip of the furthest extent of this cell. Post-Dakota deformation influenced the course of the migrating meteoric water and the extent of the redox interface controlling the orebody. As sampling and mining lower grades of uranium becomes increasingly more economical, the potential for unknown reserves adjacent to the redox interface should not be overlooked.

143 **Geology and development of Marquez, New Mexico, uranium deposit.** Livingston, B.A. Jr. (Bokum Resources Corp., Santa Fe, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 252-261(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Uranium deposition in the Marquez, New Mexico, area occurs almost exclusively in the lower Westwater Canyon Member of the Morrison Formation (Jurassic). The average aggregate thickness of the Westwater Canyon is 295 ft (90 m), but it ranges from a minimum of 239 ft (73 m) to a maximum of 328 ft (100 m). A K shale separates the upper and lower Westwater Canyon sandstone boundaries. The lower Westwater Canyon sandstone development is more pronounced in an east-southeast direction parallel with the strike of the orebody(ies). Three distinct ore zones were deposited in peneconcordant elongate patterns. The upper zone occupies a stratigraphic interval just below the K shale, and two lower zones lie above and below the $K_1$ shale. Coffinite and uraninite predominate as the stable uranium species; other extrinsic elements were added during the mineralization process. Humates undoubtedly exerted major control on formation of the uranium. Ferrous iron pervades both within and outside the deposit, whereas ferric iron, although limited in quantity, is confined principally to the orebody(ies). The lower $K_1$ shale, parameters of permeability, and recurrence of meanders along the paleochannels also seem to influence enrichment. Surface drilling is continuing, a vertical mine shaft to approximately 2,100 ft (640 m) is nearing completion, and a mill is being constructed on the property.

144 **Jackpile-Paguate deposit: a review.** Beck, R.G.; Cherrywell, C.H.; Earnest, D.F.; Feirn, W.C. (Anaconda Copper Co., Grants, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 269-275(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Uranium mineralization occurs in the Jackpile sandstone, the uppermost unit in the Brushy Basin Member of the Morrison Formation (Jurassic), north of Laguna, New Mexico. Mineralization ranges from discontinuous, spotty disseminations to lenses up to 30 ft (10 m) thick and 100 ft (30 m) long. The lenses are elongate subparallel to the northeast trend of the Jackpile sandstone. Since 1952, observations during mining have indicated that varied forms of mineralization occur within lenses, such as rodlike features, irregular and diffused masses, and discontinuous seams or wisps crosscutting channel boundaries. The positive correlation between uranium content and organic carbon for samples greater than 0.04 percent $U_3O_8$ suggests that organic carbonaceous material is a major large-scale controlling factor for the deposition of uranium. No other sig-

nificant geochemical control on mineralization can be postulated from the limited data presented.

145 **Magnitude and variability of disequilibrium in San Antonio Valley uranium deposit, Valencia County.** Moore, S.C. (Exxon Minerals Co., Albuquerque, NM); Lavery, N.G. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 276-283(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The San Antonio Valley deposit is elongate northwest-southeast, is approximately 1 mile long and 1,000 wide and averages 6 to 12 ft in thickness. This trend-type deposit has a chemically reduced mineralogy and occurs below the water table. The average disequilibrium factor for the deposit shows a 6 percent enrichment in chemical uranium; however, systematic variations occur throughout the deposit. The northeastern edge averages 14 percent excessive chemical uranium relative to equivalent uranium, and the southwestern edge is deficient in chemical uranium. Instead of applying a single correction factor to the ore reserves calculated from radiometric data, three correction factors can be used, one for each of the three northwest-southeast elongate zones. The use of multiple correction factors can improve mine planning and should increase the total amount of uranium recovered from the deposit. Vertical profiles of chemical uranium and closed-can equivalent uranium through mineralized intervals suggest dispersion of uranium daughter isotopes away from uranium concentrations in some core holes and deposition of daughter isotopes in other core holes. Horizontal data plots suggest that depletion of daughter isotopes is pronounced along the northeast edge of the deposit and that their redeposition occurs in the central and soutwest parts. Groundwater flow from northeast to southwest through the deposit may have caused the transport and redeposition of the daughter isotopes, which in turn created the longitudinal zones of uranium excess and deficiency. This flow system caused both the local migration of daughter isotopes away from uranium concentrations seen in drill cores and also the larger scale transport of daughter isotopes in the direction of the hydrologic gradient. This model is based on chemical-uranium assays and on closed-can equivalent-uranium assays.

146 **Sedimentary controls on uranium ore at L-Bar deposits, Laguna District, New Mexico.** Jacobsen, L.C. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 284-291(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Uranium at the L-Bar deposits occurs in tabular, concordant bodies that are considered segments of channel fills and bars deposited in the lower flow stages of a large, braided stream. The deposits are composed of scores and possibly hundreds of these mineralized bodies. The richer parts of the deposits are clusters of partially coalescing mineralized depositional units. Uranium mineralization is coextensive with the presence of carbonaceous material. The bulk of this carbonaceous material occurs in crossbedding laminae and as randomly distributed clasts and is detrital in origin. Accumulations of vegetal material in the flood basins of the river are the likely source of the carbonaceous matter. The partially degraded humic substances were eroded by the migrating channels of the river and incorporated in to the sandstones. Both surface and ground waters carried uranium during Morrison deposition, and this uranium was extracted and fixed by the partially degraded humic material. The critical element in the formation of the deposits was the conjunction of uranium-bearing waters and the presence of humic substances effective in extracting uranium from dilute solutions.

147 **Uranium in Todilto Limestone (Jurassic) of New Mexico: example of a Sabkha-Like Deposit.** Rawson, R.R. (Marathon Oil Co., Casper, WY). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 304-312(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The Todilto Limestone was deposited in or near a large lake that became restricted at times and evaporated to dryness. The formation has a lower limestone member and an upper gypsum member. The limestone member has been divided informally into three zones: the lower platy zone, a middle crinkly zone, and an upper recrystallized zone. The platy zone is interpreted to have been deposited below wave base under anoxic conditions. The crinkly zone has thin stromatolitic laminations that may form algal domes. The upper recrystallized zone appears in part to be a collapsed breccia caused by the removal of interbedded gypsum. Uranium ore is restricted primarily to the crinkly and recrystallized zones. These two zones may have been formed in a sabkhalike environment. A sabkha origin has been proposed for some stratiform copper deposits. The same conditions that cause copper to precipitate would also cause uranium to precipitate. Ground water bearing $U^{+6}$ could also be drawn upward by evaporative pumping through the decaying algal-mat zone where the uranium would be reduced to $U^{+4}$ and precipitated. Carbonate materials lithify early, destroying permeability, so that uranium emplacement must occur before lithification. Radioisotope dates on uraninite in the Todilto Limestone indicate ore emplacement shortly after deposition. Uranium-bearing ground water moved basinward in the underlying Entrada Sandstone and was drawn upward through the stromatolitic zones along the southwest margins of Lake Todilto where uranium was precipitated.

148 **Applications of computer modeling to the genesis, exploration, and in-situ mining or uranium and vanadium deposits.** Runnells, D.D.; Lindberg, R.; Lueck, S.L.; Markos, G. (Univ. of Colorado, Boulder). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 355-367(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The geochemical behaviors of uranium and vanadium extremely complex. Adequate characterization of the movement and deposition of these elements in nature is virtually impossible without the aid of the computer. We have modified and enlarged an existing computer model, WATEQF, to include many dissolved species and solid compounds of uranium and vanadium. The enlarged model uses thermodynamic data and equilibrium calculations to compute the state of saturation of an aqueous solution with respect to approximately 540 solid compounds and 650 dissolved aqueous species. The results can be used to interpret the behavior and interaction of aqueous solutions and minerals in such diverse situations as the genesis of uranium-vanadium deposits, in-situ mining of ores, and hydrogeochemical exploration for ore deposits. Included are three examples of the use of the model: First, water analyses from the South Platte River in Colorado are examined to see if the uranium-rich waters of this system are capable of precipitating uranium minerals in the arkosic alluvium of abandoned meanders. Second, analyses of ground waters from two known uranium deposits are modeled, with the output displayed as contour maps of the state of saturation of the waters. Third, complex solutions from an in-situ mining operation in Wyoming are examined to determine the dissolved species of uranium and vanadium, as well as the solid minerals and compounds that may control the composition and efficiency of the leaching solution.

149 **Use of helium in uranium exploration, Grants district.** DeVoto, R.H. (Colorado School of Mines, Golden); Mead, R.H.; Martin, J.P.; Bergquist, L.E. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 368-379(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The continuous generation of inert helium gas from uranium and its daughter products provides a potentially useful means for remote detection of uranium deposits. The practicality of conducting helium surveys in the atmosphere, soil gas, and ground water to explore for buried uranium deposits has been tested in the Grants district and in the Powder River Basin of Wyoming. No detectable helium anomalies related to buried or surface uranium deposits were found in the atmosphere. However, reproducible helium-in-soil-gas anomalies were detected spatially related to uranium deposits buried from 50 to 800 ft deep. Diurnal and atmospheric effects can cause helium content variations (noise) in soil gas that are as great as the anomalies observed from instantaneous soil-gas samples. Cumulative soil-gas helium analyses, such as those obtained from collecting undisturbed soil samples and degassing them in the laboratory, may reveal anomalies from 5 to 100 percent above background. Ground water samples from the Grants district, New

Mexico, and the Powder River Basin, Wyoming, have distinctly anomalous helium values spatially related to buried uranium deposits. In the southern Powder River Basin, helium values 20 to 200 percent above background occur 2 to 18 mile down the groundwater flow path from known uranium roll-front deposits. In the Grants district, helium contents 40 to 700 percent above background levels are present in ground waters from the host sandstone in the vicinity of uranium deposits and from aquifers up to 3,000 ft stratigraphically above the deep uranium deposits. The use of helium in soil and ground-water surveys, along with uranium and radon analyses of the same materials, is strongly recommended is expensive, deep, uranium-exploration programs such as those being conducted in the Grants district.

150 **Radon emanation over an orebody: search for long-distance transport of radon.** Fleischer, R.L.; Hart, H.R. Jr.; Mogro-Campero, A. (General Electric Research and Development Center, Schenectady, NY). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 380-389(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Discovery of subsurface uranium ore could be facilitated by recognition of measurable concentrations of the radioactive gas $^{222}Rn$ near the surface of the earth. Integrated measurements made over several weeks' time show promise of giving greater reproducibility than short-term measurements, which are more subject to meteorological variability. Improved methods of integrated randon measurements-free of $^{220}Rn$, thermal-track fading, and mositure-condensation effects-allow readings that generally are highly stable over time. Sixteen kilometers north of Thoreau, New Mexico, reading taken at 60-cm depth over a 13-month interval for 55 positions give different-but nearly constant-monthly readings at each position; the typical standard deviation was 22 percent. Superimposed on that stable pattern have been three periods during which spatially grouped radon readings increased by a factor of two or more over their normal values. The simplest tenable description of the increases is sporadic puffs of upflowing gas, originating from unknown depths. The measurements are consistent with an upward velocity of flow of about $10^{-3}$ cm/s (centimeters per second). If this velocity is maintained to depth, it is still insufficient to transport detectable amounts of radon from the orebody at 90-m depth, but it would be sufficient to reveal ore at 50 m or less. Downhole measurements of permeability yield values generally too low for signals to be delivered from the orebody by any of the mechanisms already modeled.

## 0503 Mining

*REFER ALSO TO CITATION(S) 123, 148*

151 **Uranium mining. A review of 1979 developments.** Cheeseman, E.W. (Rio Algom Mines Ltd., Toronto, Ontario (Canada)). pp v.2 p.1-10 of 20. annual international conference. Toronto, Ontario; Canadian Nuclear Association (1980).

From Annual conference of the Canadian Nuclear Society; Montreal, Quebec, Canada (18 Jun 1980).

The international uranium market appears to be currently over-supplied with a resultant softening in prices. Buyers on the international market are unhappy about some of the restrictions placed on sales by the government, and Canadian sales may suffer as a result. About 64 percent of Canada's shipments come from five operating Ontario mines, with the balance from Saskatchewan. Several other properties will be producing within the next few years. In spite of the adverse effects of the Three Mile Island incident and the default by the T.V.A. of their contract, some 3 600 tonnes of new uranium sales were completed during the year. The price for uranium had stabilized at US $42 - $44 by mid 1979, but by early 1980 had softened somewhat. The year 1979 saw the completion of major environmental hearings in Ontario and Newfoundland and the start of the B.C. inquiry. Two more hearings are scheduled for Saskatchewan in 1980. The Elliot Lake uranium mining expansion hearings are reviewed, as are other recent hearings. In the production of uranium for nuclear fuel cycle, environmental matters are of major concern to the industry, the public and to governments. Research is being conducted to determine the most effective method for removing radium from tailings area effluents. Very stringent criteria are being drawn up by the regulatory agencies that must be met by the industry in order to obtain an operating licence from the AECB. These criteria cover seepages from the tailings basin and through the tailings retention dam, seismic stability, and both short and long term management of the tailings waste management area.

152 **Mining of the uraniferous shales of Saelices el Chico (Salamanca).** Serrano, J.R.; Membrillera, J.R.; Criado, M.; Gomez Jaen, J.P.; Artieda, J.; Grande, L. (Empresa Nacional del Uranio, Madrid (Spain)). pp 253-274 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980). (In Spanish)

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

In July 1974 ENUSA (the National Uranium Company) started mining operations in the FE-1 deposit in the municipal district of Saelices el Chico, Salamanca province. This is a deposit of the Stockwork type and is embedded in Cambrian shales of a distinct degree of metamorphism. The primary mineralization is found filling fissures and fractures of only slight longitudinal development. The secondary minerals were deposited in the zones affected by the hydrostatic level. The investigation of the deposit was carried out by the Spanish Nuclear Energy Board (JEN). In its final phases it consisted of a control drilling campaign and a wagon-drill campaign. The deposit was evaluated by the zone-of-influence method in accordance with the control drillings and the wagon drillings. The overall rate of production was 1,200,000 t per annum, of which 200,000 t were ore with a $U_3O_8$ content of 0.08%. The output of the processing plant was 130 t $U_3O_8$. In 1976 ENUSA undertook a mining project of much greater scope in consequence of the decision to expand the ore processing plant (objective of the Quercus project). The annual output of the plant in question will be 600 t $U_3O_8$. For this the production of ore will be increased to 825,000 t/a (average grade 0.075%) and the total amount removed will be 9 million tonnes per annum. Account is taken of the whole of the FE deposit, which includes FE-1 and FE-3 and their respective extensions. The evaluation of the deposit was made both on the basis of the results of the control- and wagon-drillings and by the Kriging statistical method.

153 **Exploitation study of the ore-body "Tigre III". Open-cut design and study of high-recovery underground mining method for the Tigre III ore-body.** Baluszka, J.C. (Comision Nacional de Energia Atomica, San Rafael, Mendoza, Argentina). pp 321-342 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980). (In Spanish)

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

The paper first carries out an analysis for the purpose of determining the limiting sterile/ore ratio for open-cut and underground mining in the specific filling case of Tigre III. In this connection it considers a high-recovery method of underground mining (involving the use of cemented hydropneumatic chambers), a general mine plan covering access, transport, ventilation and removal of ore as well as auxiliary services relating to the Tigre III ore body as a whole. The costs of this method of mining are determined for purposes of comparison with the open-cut method. Similarly, the limiting sterile/ore ratio is taken as the basis for an analysis of different types of pit and a design suited to the limiting ratio is adopted. As a final solution the paper favours a method which combines open-cut and underground mining. It proposes the use of the open-cut method up to the limiting ratio (in accordance with the pit design chosen) and of underground method (by the filling chamber method) for the rest of the area.

154 **Development of the Alligator Rivers uranium deposits.** Bath, L.J.; Farthing, J.W.; Warner, R.K. (Australian Atomic Energy Commission, Coogee). pp 345-376 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

The Alligator Rivers Uranium Province in the Northern Territory of Australia has proven uranium deposits at Jabiluka, Ranger, Koongarra and Nabarlek which contain more than 80% of the country's low-cost reasonably assured uranium resources estimated to be 290,000 t U. Following the Government's decision in 1977 to proceed with the further development of Australia's uranium resources, the region is destined to become a major producer of $U_3O_8$ for export. At the time of the decision provision was made for strict controls to protect the environment, the granting of Aboriginal land rights and the creation of a major national park. The paper describes the progress made to achieve these objectives. The open-cut mining methods to be used at Ranger, Koongarra and Nabarlek are described, as well as the underground mining operations proposed for Jabiluka. Each of the treatment plants will use the conventional acid leach, solvent extraction purification process for uranium recovery. The characteristics of the treatment operations are outlined. The water-management schemes, tailings disposal methods and procedures for environment protection are also discussed. The proposed initial production capacities of the operations are: Jabiluka 2540 (expanding to 7630 in the fifth year of production); Ranger 2540 (expanding to 5080 when commercially practicable); Koongarra 850; and Nabarlek 920 t U/a. Both Nabarlek and Ranger have been granted Government development approval and construction is proceeding at each site with the expectation that normal commercial production will commence towards the end of 1980 and 1981, respectively. Planning for the Jabiluka and Koongarra projects has reached an advanced stage; each are undergoing environmental procedures and will have to reach agreement with the Aboriginals on environmental and other matters before site work can commence.

155 **Uranium solution mining: comparison of New Mexico with South Texas.** Conine, W.D. (Mobil Oil Corp., Denver, CO). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 340-343(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

In-situ uranium-leaching or solution-mining operations are currently underway in both south Texas and Wyoming. Mobil Oil Corporation is in the process of applying solution-mining technology, such as that developed at the O'Hern facility in south Texas, to uranium orebodies located near Crownpoint, New Mexico. The O'Hern facility uses an alkaline-leach process to bring the uranium to the surface, where it is removed from solution using ion-exchange resin and chemical precipitation. Line-drive and five-spot well field patterns are used to inject and recover the leach solutions. Although details of ore occurrence in New Mexico differ from those in south Texas, laboratory, engineering-design, and field-hydrology tests indicate that solution mining of uranium should be feasible in New Mexico. To determine the commercial feasibility, Mobil is proceeding with the construction of pilot-plant facilities for a 75-gallon-perminute (gpm) test at an orebody near Crownpoint. The pilot test will use five-spot patterns at various spacings for production of uranium-bearing leachate. Initial surface processing will be the same as that used in south Texas.

## 0504 Feed Processing

*REFER ALSO TO CITATION(S) 152*

156 **Impact of new technology on the economics of uranium production from low-grade ores.** Simonsen, H.A.; Boydell, D.W.; James, H.E. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Extraction Metallurgy Div.). pp 92-178 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

The subject is discussed under the following headings: influence of a depressed market on uranium supply from low-grade ores; potential areas for a reduction in uranium ore processing costs; in-situ leaching (solution mining; heap leaching; resin-in-pulp; solvent-in-pulp; belt filtration; continuous ion exchange; solvent extraction); preconcentration (upgrading of coarse rock; upgrading in the mill; wet high-intensity magnetic separation; flotation); summary and conclusions.

157 **Potential by-product uranium production in the United States of America.** McGinley, F.E. (Department of Energy, Grand Junction, CO (USA). Grand Junction Office). pp 293-305 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

When evaluating uranium resources, one must not overlook the possibilities of recovering uranium as a by-product of other industries. The technology for recovering by-product uranium from phosphoric acid has been known for many years, but only recently have market conditions encouraged production. Even with recent improvements in process technology, many problems are still encountered in scale-up from laboratory and pilot plant operation to commercial production. Some of these problems are discussed in this review of the process technology. A recent USDOE study shows a total capital cost of US $12 million for a by-product uranium plant designed to recover 40 to 60 t U/a from 30% $P_2O_5$ acid provided by a phosphoric acid plant with a capacity of 155,000 t $P_2O_5$/a. Operating costs were estimated at US $50 to 65/kg U ($20-25/lb $U_3O_8$), assuming the phosphoric acid contains 120 to 160 mg U/l and a raffinate of 13 mg U/l. The quantity of uranium recovered and the operating costs are highly sensitive to the uranium content of the acid. Constraints to by-product uranium production, besides low uranium content of the acid are small-size phosphoric acid plants and high strength (>40% $P_2O_5$) acid. Similarly the technology for recovery of uranium from copper waste dump leach liquors has been known for several years. It was developed in the mid-1960s by the US Bureau of Mines in co-operation with Kennecott Copper Corporation at its Bingham Canyon mine near Salt Lake City, Utah. Commercial application was first realized when an ion-exchange plant to recover about 55 t U/a commenced operation in 1978.

158 **Chemeca 80: process industries in the 80's. Proceedings of the eighth Australian Chemical Engineering conference, August 24-27, 1980.** Melbourne, Australia; Institution of Engineers (1980). vp. (CONF-8008106—).

From 8. Australian chemical engineering conference; Melbourne, Australia (24 Aug 1980).

Separate abstracts have been prepared for individual items within scope for inclusion in the Energy Data Base.

159 **Application of the VAW tube digester for metallurgical pressure-leaching processes.** Kaempf, F. (Vereinigte Aluminium-Werke A.G., Bonn (Germany, F.R.)); Pietsch, H.B. (Lurgi Chemie und Huettentechnik G.m.b.H., Frankfurt am Main (Germany, F.R.)). pp 33-35 of Complex metallurgy '78. Papers presented at an international symposium organized by Gesellschaft Deutscher Metallhuetten-und Bergleute and the Institution of Mining and Metallurgy, held in Bad Harzburg, Federal Republic of Germany, from 20 to 22 September 1978. Jones, M.J. (ed.). London, England; Institution of Mining and Metallurgy (1978).

From Conference on complex metallurgy; Bad Harzburg, F.R. Germany (20 Sep 1978).

Problems associated with the treatment of complex and refractory ores or concentrates, as well as those related to environmental factors, have led to increased interest in hydrometallurgy under elevated temperatures and pressures. Pressure leaching can be carried out in vertical, horizontal or spherical autoclaves equipped with mechanical agitators. If high throughput capacities are catered for, the division of a conventional plant into several units is inevitable. By contrast, the VAW (Vereinigte Aluminium-Werke Aktiengesellschaft) tube digester enables hydrometallurgical processes to be carried out under pressure and at a high temperature with the use of a basically simple technology, extremely high specific throughput and improved thermal economics being achieved. The advantages of the tube digester over vessel autoclaves are described, and details of laboratory investigations into the applicability of tube digesters to various metallurgical applications are given. Test results are given for the leaching of refractory uranium ores.

160 **Complex metallurgy '78.** Jones, M.J. (ed.). London, England; Institution of Mining and Metallurgy (1978). vp. (CONF-7809244—).

From Conference on complex metallurgy; Bad Harzburg, F.R. Germany (20 Sep 1978).

Separate abstracts have been prepared for individual items within scope for inclusion in the Energy Data Base.

## 0505 Enrichment

161 **Plasma centrifuge I: Uranium partial pressure distributions.** McClure, J.J.; Nathrath, N. (Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.)). pp 693-694 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

162 **Plasma centrifuge III: Measurements on rotating uranium plasmas.** Nathrath, N. (Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.)). pp 697-698 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

## 0507 Fuels Production And Properties

*REFER ALSO TO CITATION(S) 671, 672, 673, 706, 707, 747, 770, 792, 793, 794, 795, 797, 798, 799, 800, 804, 805, 808, 809, 810, 847, 851, 852*

163 (EUR—6929, pp 331-348) **Considerations on a sol-gel type process as a fuel fabrication route for the actinide recycle.** Facchini, A.G.; Gallone, S. (AGIP Nucleare, Milan (Italy)); Zamorani, E. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1980. Dep. NTIS (US Sales Only).

From 2. technical meeting on the nuclear transmutation of actinides; Ispra, Italy (21 Apr 1980).

The technology based on the powder pelletizing faces relevant difficulties, when used to fabricate both targets and fuels containing transplutonium elements. The applicability of the Gel-Supported Precipitation process (GSP) as an alternative, has been examined on the ground of the know-how gained in producing U-Pu mixed oxide microspheres or granules suitable for pressing. The applicability of the process has been examined on the basis of the following factors: - the properties of the actinide solutions obtained through the HAW partitioning; - the target and fuel element composition and geometry which must be met in order to perform a homogeneous or a heterogeneous recycle in the FBR's and in the LWR's; - the actinide radiolytical effects on the compounds used to produce either microspheres or granules; - the criticality aspects. This paper shall be considered as a first attempt only; however, it can be useful in evaluating the different alternatives from the GSP fabrication standpoint. Moreover, some areas for further experimental research are indicated to confirm the applicability of the GSP process.

164 **Measurement and analysis of stress rupture tests on CAGR cladding tubes.** Clay, B.D. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Bazell, C.C. (UKAEA Atomic Energy Establishment, Winfrith). pp 363 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

165 **Simultaneous multielement precision isotope analysis of nuclear fuel.** Koch, L. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements); Steinert, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie). pp 330-336 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

The subject is discussed under the headings: general; ionization efficiencies; multielement analysis; isotope analysis of an americium and curium mixture; isotope analysis of a mixture of thorium, uranium and plutonium; direct burn-up analysis by isotope dilution mass spectrometry; isotope analysis of a caesium and barium mixture.

166 **Precipitation reactions in austenitic stainless steels.** Hoch, M.; Yung-Shih Chen (Cincinnati Univ., OH (USA). Dept. of Materials Science and Metallurgical Engineering). pp 331-348 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The precipitation reactions for commercial austenitic stainless steels (AISI type 347, 321, 316, 316L, 304 and 304L) and titanium-modified AISI type 316 SS were studied over the temperature range of 750-1350°C. Specimens were held at temperature for 15 to 25 hours to ensure that equilibrium conditions were reached. This was followed by a water quench to prevent further precipitation reactions during the cooling process. The precipitates were extracted from bulk specimens by anodic dissolution and identified by X-ray diffraction analysis. In titanium-stabilized 321 SS, large TiN and $Ti_2S$ ($Ti_4C_2S_2$) precipitates were present in solution-treated and subsequently annealed specimens. Small TiC precipitates were present in specimens annealed below 1150°C. $M_{23}C_6$ precipitates were found to be present after annealing at 850°C for 25 hours. The amount of $M_{23}C_6$ was found to increase with decreasing titanium content, as shown in the titanium-modified 316 SS. In niobium-stabilized 347 SS, Nb(CN) precipitates were present in solution-treated as well as annealed specimens. The $M_{23}C_6$ precipitates were detected at an annealing temperature of 1050°C, which is higher than the precipitation temperature detected in 321 SS. Thermodynamic calculations were carried out to obtain the temperature at which precipitation starts, and the temperatures where 50, 90 and 99% of the precipitates should be formed.

167 **Summary of the symposium.** O'Hare, P.A.G. (Argonne National Lab., IL (USA)). pp 383-389 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

A short review is done of the main problems discussed on the fifth IAEA International Symposium on Thermodynamics on Nuclear Materials (Juelich, F.R. Germany, 1979). The papers, presented to the Symposium contained results of the last five years investigations of both basic science and technology of nuclear materials. The main topics are as follows: equation-of-state studies, oxide fuels, thermodynamic aspects of the behaviour of fission products, clad alloys performance, vaporization data for nuclear materials and some others. A special session was devoted to the subject of phase diagrams.

168 **Basic design requirements for the containment system of a mixed oxide fuel fabrication plant.** Cardinale, A.; Grillo, P. (SF-Combustibili per Reattori Veloci SpA, Milan, Italy). pp 519-530 of Management of gaseous wastes from nuclear facilities. Proceedings of an international symposium jointly organized by the IAEA and the NEA of the OECD and held in Vienna, 18-22 February 1980. Vienna, Austria; International Atomic Energy Agency (1980).

From International symposium on management of gaseous wastes from nuclear facilities; Vienna, Austria (18 Feb 1980).

This paper describes the updated basic design requirements for the containment system of a mixed oxide fuel fabrication plant. The design has been developed on the basis of safety goals, taking into account the environmental compatibility under both normal and accident conditions. The different sources of risk, which might cause a mixed oxide release to the environment, are analysed with regard to the system performances. In particular, this paper describes both the operational containment leakages and the basic accidents that could occur, such as a fire causing primary containment unavailability. In each possible accident situation a fault tree analysis was developed with the aim of defining the availability requirements of the most important components relevant to nuclear safety. The study points out that nuclear safety goals are attained using industrial process components, while a higher quality level is required only for components performing protection functions. Finally, a general discussion is carried out to prove the attainment of the previously stated goals, on the basis of the evaluation of releases and of their probability. The conclusion reached was that the environmental impact of a mixed oxide fuel fabrication plant can be kept at a very low level.

169 **Experimental verification of stress model calculations for HTR fuel particles.** Herren, M.; Krautwasser, P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen); Mehner, A.W. (Hochtemperatur-Reaktor-Brennelement G.m.b.H. (HOBEG), Hanau (Germany, F.R.)). pp C2/1 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

The fissile and fertile material for gas cooled high temperature reactors is contained in microspheres coated with several pyrocarbon (PyC) and silicon carbide (SiC) shells. The basic performance-limiting phenomenon in fuel particles is pressure vessel failure. The effects of irradiation temperature, neutron exposure, kernel burn-up and kernel and coating dimensions and densities on PyC and SiC coating layer stresses can be estimated using coated particle stress analysis codes. The reliability of these calculations have to be proven by experimental verification. A new method was established to calculate failure rates directly for an unlimited number of particle parameter having a statistical distribution using a simplified time saving version of the Walther model. Material properties and geometry data from kernel and coatings are used as input parameters. For the kernel, Young's modulus, and fuel swelling are constant whereas fission gas release from the kernel is a function of burnup. For the coatings Young's modulus, Poisson ratio, irradiation induced creep coefficient, Poisson ratio in creep, irradiation induced unrestrained dimensional change rate in tangential directions are treated as function of neutron fluence. Material strength in tangential direction is treated as constant. From the calculated stresses and reasonable failure criteria for PyC and SiC the number of defective particles can be predicted for irradiation experiments.

170 **Statistical methods for predicting failure probability of coated particles.** Gehr, H.L. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)); Bongartz, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). pp C2/2 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

Different methods for predicting the failure probability of TRISO feed particles used in HTR fuel elements are presented. The application of one or the other of these statistical approaches to a particular problem depends on the type of problem and the conclusion to be drawn from the evaluation.

171 **Stress performance calculations as a guide for layout and testing of coated fuel particles for HTRs.** Bongartz, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). pp C2/3 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

A new computer program for stress calculations has been developed which is a simplified version of the very versatile but time consuming Walther model. The only simplifcation is the assumption of a quasi rigid siliconcarbide layer which is allowable. A new method was established for calculating failure fractions directly for an unlimited number of particle parameter having a statistical distribution using the new stress program. It requires relatively low computation times which makes it useful tool for iterative calculations in particle optimization.

## 0508 Spent Fuels Reprocessing

*REFER ALSO TO CITATION(S) 220, 431, 745, 866, 992, 993*

## 0509 Transport And Storage

*REFER ALSO TO CITATION(S) 355*

172 (INIS-mf—6447, pp vp) **Motor carrier routing using the COMPU.MAP program.** Seagren, R.D.; Hudson, B.J.; Joy, D.S. (Oak Ridge National Lab., TN (USA). Chemical Technology Div.). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

173 (INIS-mf—6447, pp vp) **Transport of spent light water reactor fuel by goods train. Estimation of potential release in the event of accidents.** Anspach, W.; Schneider, K. (Transnuklear G.m.b.H., Hanau (Germany, F.R.)); Baran, A. (Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

174 (INIS-mf—6447, pp vp) **Safety analysis on transportation of radioactive materials by truck in Japan.** Nagakura, T.; Fukuda, S. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Nuclear Power Dept.); Takagi, S.; Shikata, H.; Ichikawa, Y. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.); Takano, H.; Maki, Y. (Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Civil Engineering Lab.). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

175 (INIS-mf—6447, pp vp) **Environmental impact of plutonium transport in the event of accidents within the European Community. Estimation of potential releases.** Schneider, K.; Anspach, W. (Transnuklear G.m.b.H., Hanau (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

176 (INIS-mf—6447, pp vp) **Risk assessment for the transportation of $PuO_2$, $UF_6$ and spent fuel on roads in the Federal Republic of Germany.** Hartwig, S.; Flothmann, D.; Heudorfer, W.; Krieger, E.; Roos, G.; Schnatz, G.; Wuerdemann, G. 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

177 (INIS-mf—6447, pp vp) **Radioactive materials packages and the British railway accident environment.** Taig, A.R. (UKAEA, Warrington. Safety and Reliability Directorate). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

178 (INIS-mf—6447, pp vp) **Liability and insurance during international transports of nuclear fuel.** Timm, U.E. (Transnuklear G.m.b.H., Hanau (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

179 (INIS-mf—6447, pp vp) **Implications of the new limits for intake (ICRP 26 and ICRP 30; on the $A_1$ and $A_2$ values.** Lange, F.; Mueller, W. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

180 (INIS-mf—6447, pp vp) **Protection and security of transport of special nuclear materials (including measures for the transportation by rail:.** Alter, U.; Jungklaus, D. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

181 (INIS-mf—6447, pp vp) **System of insurance and indemnity coverage for public liability associated with nuclear materials in the course of transportation in the United States.** Brown, O.F. (Department of Energy, Washington, DC (USA). Office of the General Counsel). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

182 (INIS-mf—6447, pp vp) **It's a mad mad world.** Mangusi, J. (Transnuclear, Inc., New York (USA)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

183 **Drum system CEFE - a new double door transfer system.** Brossard, J.P. (S.A. La Calhene, France). pp 341 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

## 0510 Marketing And Economics

*REFER ALSO TO CITATION(S) 100*

184 **Long term uranium supply outlook.** Patterson, J.A. (Department of Energy, Washington, DC (USA)). pp 64-85 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

The subject is discussed under the headings: long-range concerns; considerations of long-term supply; uranium resources; resource estimates (reasonably assured resources (RAR) and estimated additional resources (EAR)); speculative resources (International Uranium Resource Evaluation Project); higher cost resources; discovery rate experience; attainable production levels - RAR and EAR; production from speculative resources; supply/demand comparison; resource economics; uranium availability; conclusions.

185 **(NP—2900892) Low-level radioactive waste management: an economic assessment.** Peery, R.J. (State Planning Council on Radioactive Waste Management, Washington, DC (USA); Southern States Energy Board, Atlanta, GA (USA)). Jul 1981. 39p. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585. Order Number DE82900892.

This paper has presented an overview of the economics of low-level radioactive waste disposal. It is hoped that this paper will assist the states in their efforts to determine their approach to the management of low-level wastes. Although the economies of scale realized by a larger facility are emphasized, the conclusion is that every state and region must examine its need for low-level waste disposal services and consider the interrelated factors that affect the volume of waste to be disposed, including waste reduction techniques, interim storage for radioactive decay, legal issues, and the demand for services as the price of these services change. The result is not a single recommended capacity for a facility, but an acknowledgement of contingencies. In theory, per cubic foot disposal costs decrease as facility size increases. But theory does not preclude a state from constructing its own site, or a region generating small volumes of waste from building a shared facility. All factors should be weighed before a site is chosen and its size is determined.

186 **Enrichment industry reaches maturity.** Rougeau, J.P. (Societe EURODIF, 92 - Bagneux (France)). pp 183-189 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

As the nuclear power industry enters the 1980s, uranium enrichment supply can no longer be considered one of the critical problem areas of the nuclear fuel cycle. It has become an industrial and commercial activity which has reached a high degree of matu-

rity. Three main aspects of this maturity are discussed: 1. the availability of enrichment services from several facilities with very diverse ownership; 2. the involvement of private industry, especially in Europe, and the application of normal commercial rules to enrichment contracts; 3. the ability of the enrichment industry to cope with recent setbacks in the advancement of nuclear power programmes whilst carrying out an active research and development programme that will help to ensure its future technical and economic viability.

## 0520 Waste Management

*REFER ALSO TO CITATION(S) 60, 185, 231, 240, 613, 675, 704, 705, 708, 714, 716, 717, 718, 728, 814, 846, 872, 1008*

187 (EUR—6929, pp 293-330) **Design of fuel pins containing by-product actinides for irradiation in LWR and FBR power plants.** Zamorani, E.; Cametti, J.; Schmidt, E. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Caligara, F. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements); Moreno, A. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari). 1980. Dep. NTIS (US Sales Only).

From 2. technical meeting on the nuclear transmutation of actinides; Ispra, Italy (21 Apr 1980).

The irradiation of a fuel pin in a nuclear power plant drastically modifies the structure of the starting materials so that in some cases failures of the clad can occur. On the basis of the knowledge gained in the U-Pu MOX system, calculations have been performed with the CODACT and TPROF computing codes in order to investigate the behaviour of fuel pins and target elements containing oxides of Np-Am-Cm for homogeneous and heterogeneous recycling in LWR and FBR. The irradiation conditions must assure that: the specific power rating (W/cm) does not exceed the value accepted for a normal fuel; the central temperature is compatible with the melting point of the materials or with possible eutectic temperature; thermodynamic conditions leading to dangerous fuel-clad interaction are avoided. The calculations show that this hold true for homogeneous pellet of current fuels containing up to 1% actinide oxides (Am, Cm, Np), while the heterogeneous concept for FBR request modification of the pin geometry and of the fuel composition and implies supplementary costs and difficulty for the fabrication. Dense pellets of actinide oxides blended with the inert diluent MgO seem to be the most promising solution. The critical evaluations of the parameters influencing the central temperatures and the radial oxygen profiles are made on a purely theoretical approach because of the lack of experimental data concerning the solid phases containing actinide oxide.

188 **Scientific basis for nuclear waste management. Volume 3.** Moore, J.G. (ed.). New York, NY; Plenum Press (1981). 637p. (CONF-801124—(Pt.1)). Contract W-7405-ENG-26.

From. 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The third International Symposium on the Scientific Basis for Nuclear Waste Management was held in Boston, Massachusetts, on November 17-20. The purpose of this Symposium was to provide an interdisciplinary forum for the discussion of scientific research dealing with all levels and types of radioactive wastes and their management. The 77 papers published in these proceedings have been divided into the following categories: repository characterization; high-level waste forms which covers assessment and head end processing, vitreous materials, and crystalline materials; non-high-level waste; natural analogues; leach studies; radiation effects; radionuclide migration; engineered barriers; and performance assessment. All papers have been abstracted and indexed.

189 **(NP—2900893) Low-level radioactive waste management: case studies on commercial burial sites.** (State Planning Council on Radioactive Waste Management, Washington, DC (USA)). Aug 1981. Contract M82900893. 194p. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585. Order Number DE82900893.

The two case studies of the low-level waste disposal facilities in Barnwell, South Carolina, and in Beatty, Nevada have been prepared as informational documents for use by officials of states and local communities when they consider the desirability and feasibility of establishing a low-level waste facility in their communities. Contents covered are: site description; licensing and regulation; operation; community relations; problems and solutions; operational lessons; and role of the state of South Carolina. (ATT)

190 **Proceedings of the workshop on borehole and shaft plugging, Columbus, 7-9 May 1980.** Paris, France; OECD (1980). vp. (CONF-800527—).

From International BHP symposium; Columbus, OH, USA (7 May 1980).

Separate abstracts are presented for each of the conference paper included in the data base.

191 **Experience of management of plutonium-contaminated solid and liquid wastes at the Cadarache Nuclear Research Centre.** Marcaillou, J.; Faure, J.C.; Tourret, G. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). pp 93-108 of Management of alpha-contaminated wastes. Proceedings of an international symposium organized by the IAEA and the Commission of the European Communities and held in Vienna, 2-6 June 1980. Vienna, Austria; IAEA (1981). (In French)

From International symposium on the management of alpha-contaminated wastes; Vienna, Austria (2 Jun 1980).

At Cadarache the principal sources of alpha-contaminated waste are the facilities of the plutonium fuel assembly fabrication complex. The chosen management scheme shows two points where it is possible to implement procedures to limit the activities released and to reduce the storage volumes of treated waste: (1) At the fabrication units, three categories of solid waste ('rich', 'poor' and 'special') are distinguished by sorting at the time of production and by $\gamma$,n counting of the drums. The rich and special wastes with a high plutonium content are stored while awaiting treatment for recycling of the plutonium. In the case of liquid waste, different circuits are used to separate contaminated effluents and thus to limit their production; (2) In the solid-waste treatment shops, the waste has so far been compacted and then coated with bituminous cement mortar. At the same time, a new incinerator facility has been installed. The preliminary studies dealt mainly with: waste preparation (crushing) to obtain a continuous and regular feed for the incinerator; combustion (pyrolysis followed by burning of the gases and unburnt matter in the presence of excess air); containment of the equipment. Further studies will be made to determine what is to be done with the ash (treatment for plutonium recovery and/or coating). At the Effluent Treatment Station some adjustments have had to be made in order to cope with the increase in volume activity due mainly to the presence of americium. At the same time, with a view to limiting the production of treatment residues with a high alpha-emitter content it has been decided to carry out a research and development programme on the separation of americium and the improvement of the recycling of the plutonium contained in the process effluents.

192 **Management of sodium-bearing transuranic waste and scrap materials.** Mann, S.A. (United States Department of Energy, Chicago Operations and Regional Office, Argonne, IL); Abrams, C.S. (Argonne National Lab., Idaho Falls, ID (USA)). pp 153-163 of Management of alpha-contaminated wastes. Proceedings of an international symposium organized by the IAEA and the Commission of the European Communities and held in Vienna, 2-6 June 1980. Vienna, Austria; IAEA (1981).

From International symposium on the management of alpha-contaminated wastes; Vienna, Austria (2 Jun 1980).

The liquid-metal fast-breeder reactor (LMFBR) experimental programme in the United States of America produces transuranic scrap and waste that contain elemental sodium. These materials are not acceptable at reprocessing or disposal facilities because of the elemental sodium. Methods therefore need to be developed for removing the sodium and converting it to an acceptable form for disposal, or purifying it for reuse. The United States Department of Energy (DOE) has established a Sodium Waste Technology Program to develop and demonstrate such methods. The primary source of this type of material is the Argonne National Laboratory-West site, which Argonne operates for DOE at the Idaho National

Engineering Laboratory. Some of this material consists of sodium-bounded axial blanked rods, which were discarded during the past operation of a closed fuel cycle at Experimental Breeder Reactor II (EBR-II). Other material is now being generated from removal of EBR-II radial-blanket subassemblies, and from fuel testing to failure in the Sodium Loop Safety Facility. The Sodium Waste Technology Program has the following objectives: (1) Selection of a safe process for removing sodium from scrap and waste; (2) testing of the process and construction of a shielded facility; (3) selection of processes for treating the removed sodium for disposal or reuse; (4) applying the developed techniques to generic waste problems of future LMFBRs; and (5) extending the technology to decontamination and decommissioning of LMFBRs. Plans are under way to test a Melt Drain Evaporation Calcination (MEDEC) process, in which sodium will be removed by draining and evaporation and will be converted by calcination to sodium oxide. The oxide could then be made into a glass for final disposal of transuranic wastes.

193 **Basalt waste isolation project data package for reference physicochemical conditions.** Coons, W.E. (Rockwell Hanford Operations, Richland, WA). pp 11-18 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

This package defines the physicochemical conditions expected to prevail in a closed nuclear waste repository mined from Columbia River Basalt. Estimates have been derived from experimental data, in-situ measurements, or thermodynamic calculations. Equations are provided from estimation of $fO_2$, Eh and pH as a function of temperature. Expected conditions are summarized.

194 **Evaluation of product specifications with a safety analysis for a disposal mine.** Warnecke, E.; Illi, H. (Physikalisch-Technische Bundesanstalt, Braunschweig, Germany). pp 19-26 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

This work was done on the basis of preliminary data for radioactive wastes generated in a future reprocessing plant and assumptions of the geology and hydrology of the salt dome at Gorleben. It showed that it is possible to come to quantitative requirements for type specific radioactive waste forms with an iterative safety analysis for a repository if a suitable data base is available.

195 **Predicting the reaction state of brines in proposed regions of nuclear waste isolation.** Bassett, R.L.; Bentley, M.E.; Duncan, E.A.; Griffin, J.A. (Univ. of Texas, Austin). pp 27-34 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

This paper describes the preliminary investigation of the Bureau of Economic Geology into the reaction state of subsurface fluids in the Texas Panhandle. The fluids most likely to interact with nuclear waste materials buried in evaporite strata are brines. An accurate characterization of the potential for these fluids to react with the host media or the buried waste requires a mathematical model that describes the ionic behavior in concentrated aqueous electrolyte solutions. Preliminary computations with the new computer model AQ/SALT indicate that equilibrium between anhydrite and the deep formation brines may be widespread. The shallow brines resulting from active salt dissolution are derived from undersaturated ground water, which dissolves both halite and anhydrite, then quickly comes to equilibrium with gypsum. Calcium sulfate is being removed from the basin largely because of increasing ionic strength from halite dissolution, even though the fluids are following the anhydrite or gypsum phase boundary. Characterization of the carbonate system will require additional chemical and thermodynamic data, which should be available soon.

196 **Laboratory investigation of water content within rock salt and its behavior in a temperature field of disposed high-level waste.** Jockwer, N. (Gesellschaft fuer Strahlen- und Umweltforschung mbH, Institut fuer Tieflagerung, Braunschweig, Germany). pp 35-42 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The investigation of rock salt from different North German salt mines showed that at least three components of water exist within the rock salt. The majority of the water is from water of hydration of the minor minerals in the salt and from intergranular water adsorbed to the crystal boundaries. The amount of water from fluid inclusions in the salt of North German mines is comparatively low. In order to investigate the thermal liberation of the different water components within the rock salt, the loss of weight as a function of time at different constant temperatures between 90 and 630°C was measured. Salt samples from the Asse salt mines from different depths and stratigraphic layers were analyzed for their water content. Water content was not constant but depended on the amount of minor minerals present containing water of hydration. As the majority of the water within the rock salt is associated with the minerals polyhalite and kieserite, the thermal behavior and the liberation of the hydration water from these minerals were analyzed. The liberation temperature of water was found to be dependent on the humidity of the air above the sample. The diffusivity of rock salt samples from the Asse salt mines was measured and was found to decrease with increasing temperature, which meant that it is inversely proportional to the water vapor within the intergranular spaces.

197 **Thermal conductivity of selected repository minerals.** Skvarla, M.F.; Vandersande, J.W.; Linvill, M.L.; Pohl, R.O. (Cornell Univ., Ithaca, NY). pp 43-50 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

For the assessment of the safety of nuclear waste disposal in a geologic repository, knowledge of the near- and far-field temperature profile is of utmost importance. For a given thermal loading, this profile is determined largely by the thermal conductivity of the rock in which the repository is constructed. It is the purpose of the present investigation to explore the range of conductivity that may be expected in granite, basalt and rock salt, and to search in particular for their lower limits. The concept of the minimum thermal conductivity has been suggested as a means of estimating an upper limit of the temperature rise around a waste disposal site located in granitic or basaltic rock. For rock salt, however, this concept is less useful, and more systematic studies will be needed to determine the range of conductivity to be expected, and to identify the regions which have either unacceptably low thermal conductivities, or those in which irreversible change may occur as a result of the emplacement of the nuclear waste.

198 **Geoscientific evaluation of radioactive waste isolation in Japan.** Doi, K. (Radioactive Waste Management Center, Tokyo, Japan). pp 59-65 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Japan has been hit by several kinds of calamities related to geologic events, and the recurrence of such events is still a possibility in most parts of the country. Accordingly, it would be difficult to find a favorable site for the permanent storage of radioactive waste, but the author believes that a site suitable for retrievable storage could possibly be found. In this region of a high degree of faulting and relatively large groundwater flows, it is necessary to satisfy the following factors to derive a favorable area for radioactive waste isolation: (a) areas with little or no volcanic or recent tectonic activity, such as active faults or active volcanoes; (b-1) geologic formations with little or no flowing groundwater; and (b-2) formations where all or most of the groundwater is easily con-

trolled by artificial drainage. Some of the Neogene argillaceous sediments may be favorable because they satisfy the factor (b-1). Some Neogene argillaceous sediments have fewer faults and fractures; this is because tectonically induced stress has been absorbed by the plasticity of the rocks. Generally, the argillaceous sediments in the region contain water, but most of the water is bound by clay minerals contained in the rocks and is not free to migrate. Palaeozoic calcareous formations potentially satisfy the factor (b-2). In several areas of the region, dry limestone mines exist in these formations. The groundwater in limestones would have to be gathered into a drainage system below the repository by draining either natural fractures or cave systems.

199 **Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes.** Schulz, W.W.; Beary, M.M.; Gallagher, S.A.; Higley, B.A.; Johnston, R.G.; Kupfer, M.J.; Palmer, R.A. (Rockwell Hanford Operations, Richland, WA). pp 67-74 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Borosilicate Glass Marbles and/or monoliths were rated among the top three waste forms for immobilization of all types of Hanford high-level waste. Supergrout Concrete and Bitumen, low temperature processes, are judged to be particularly suitable for immobilization and bulk disposal of high sodium blended wastes and/or residual liquid. This preliminary assessment indicates that certain ceramic waste forms (e.g., Tailored Ceramics, Supercalcine Ceramic, and SYNROC Ceramic) are equal to or superior to Borosilicate Glass waste forms for immobilization of Hanford sludges and radionuclides removed from salt cake and residual liquid. These ceramic waste forms can be made by the Sol Gel process. Some multibarrier waste forms (e.g., Coated Ceramics, Ceramic Pellets in Metal Matrix, and Glass in Metal Matrix) are judged to be superior waste forms for immobilization of Hanford sludges and/or radionuclide concentrate.

200 **ESCA investigation of molybdenum containing silicate and phosphate glasses.** Nyholm, R. (Univ. of Uppsala, Sweden); Werme, L.O. pp 101-108 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Investigations have shown that fission products containing borosilicate glasses sometimes show a separated, yellow, alkali molybdate phase. It has been found that additives to the glasses as well as changes in melting conditions influence this phase separation. Knowledge of state and structure of molybdenum in glasses is, therefore, important. In this work simple silicate glasses containing $MoO_3$ were investigated by ESCA (electron spectroscopy for chemical analysis) using as a reference a simple phosphate glass. The Mo 3d spectrum in phase-separated and nonphase-separated glasses was investigated. The $MoO_3$ composition of the glasses varied from 2, 4, and 8%. Both oxidizing and reducing conditions were used for the 2% $MoO_3$ glasses. For the 4 and 8% glasses only oxidizing conditions were used. The recorded Mo-spectra are presented and results discussed.

201 **Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses.** Schreiber, H.D.; Balazs, G.B.; Williams, B.J.; Andrews, S.M. (Virginia Military Inst., Lexington). pp 109-114 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The objectives of this experimental study were threefold: (1) to investigate the U(VI)-U(V)-U(IV) redox equilibria in Ca-Mg-Al-silicate glass as a function of base composition, melt temperature, imposed oxygen fugacity, and total uranium content, (2) to relate the optical spectra of the uranium-containing glasses to the structural sites occupied by individual uranium redox species, and (3) to compare the uranium redox equilibria to the redox equilibria of other multivalent elements in identical glasses. Uranium in Ca-Mg-Al-silicate glasses has been shown to exist as U(VI), U(V), and U(IV) ions, each with their unique structural site within the glass. The proportion of uranium in each redox state is controlled by the synthesis conditions. The properties of the nuclear wasteform glasses are controlled by the bulk composition, equipment, temperature, time, atmosphere, and cooling rate during the processing of the glasses. However, these parameters in turn are ultimately explained in part by the redox chemistry of the melts. A fundamental understanding of the basic chemistry may go a long way in deciphering the wasteform properties - thermal stability, radiation damage, bulk properties, physical strength, and corrosion. By constraining uranium and other redox elements to exist in specific redox/structural states within the glass, one may obtain additional glass stability or other favorable properties for nuclear waste immobilization.

202 **Stable product low leach glasses.** Karkhanis, S.N.; Melling, P.J.; Fyfe, W.S.; Bancroft, G.M. (Univ. of Western Ontario, London). pp 115-122 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Glasses can be tailored to produce leach solutions that will precipitate stable minerals with suitable sites for radioactive waste ions and good ion retention properties. A series of such SPLEG (Stable Product Low Leach Glass) glasses have been prepared and their leaching and hydrothermal devitrification behaviour studied. The glasses we have produced are based on tourmaline, montmorillonite and calcium phosphate and their hydrothermal devitrification products are apatites and clay minerals or zeolites.

203 **Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach.** Nesbitt, H.W.; Bancroft, G.M.; Karkhanis, S.N.; Fyfe, W.S. (Univ. of Western Ontario, London). pp 131-138 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

In this paper, we show that the thermodynamic stability and kinetic reactivity of waste forms will be influenced - and even controlled - by the nature of the backfill and repository materials. We emphasize that it is necessary to consider the nuclear waste host, backfill and repository rocks as one chemical system, so that the whole system is unreactive. To illustrate this philosophy, we give an example of our approach using sphene ($CaTiSiO_5$) as the nuclear waste host (without radwaste components), clays as backfill, and granite as the repository system. Clays and granites have generally been considered in nuclear waste programs, and we show that sphene is thermodynamically stable relative to perovskite in waters equilibrated with this system. Sphene has other desirable properties as a waste host which will be discussed.

204 **Tailored ceramic nuclear waste forms: preparation and characterization.** Harker, A.B.; Jantzen, C.M.; Morgan, P.E.D.; Clarke, D.R. (Rockwell International Science Center, Thousand Oaks, CA). pp 139-146 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Simple tailoring and processing can be used to accommodate all of the radionuclides in SRP waste at 30 to 90% waste loading into magnetoplumbite and uraninite radiophases by taking advantage of the natural elemental content of the waste. The remaining waste elements and tailoring additives form inert encapsulant phases such as spinel, corundum, pseudobrookite, and perovskite depending on the type of tailoring. Examination of the individual phases before and after leaching has demonstrated that continuous intergranular amorphous phases enhance leachability and, therfore, highly reactive powders have been used to produce fine grain ceramics and limit the intergranular amorphous material. The magnetoplumbite has proven to be leach resistant and to accept a wide range of elements in solid solution.

205 **Recent progress on SYNROC development.** Ringwood, A.E. (Australian National Univ., Canberra); Reeve, K.D.; Tewhey, J.D. pp 147-154 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The bulk leachability of a sample of SYNROC, based on cesium extraction by deionized water at 85°C, fell from an initial value of 0.6 g/m².day on the first day to 7 x $10^{-3}$ g/m².day after 25 days. This latter leach-rate is about 300 times less than that for PNL76-68 borosilicate glass under similar conditions. A modest extrapolation of existing data suggests that SYNROC would be less leachable than glass by a factor exceeding 1000 after 55 days. Preliminary leach results for other elements are also reported. They indicate that the leachability of SYNROC, fabricated according to our current specifications, would be very much smaller than that of borosilicate glasses under realistic geologic conditions. Detailed studies of the effects of radiation damage on the crystal structures and radionuclide retention of SYNROC minerals under geologic conditions have been completed and confirm that the ability of SYNROC to immobilize HLW safely for millions of years is not adversely affected.

206 **Matrix-encapsulated waste forms: application to idealized systems, commercial and SRP/INEL wastes, hydrated radiophases and encapsulant phases.** Roy, R.; Vance, E.R.; McCarthy, G.J.; White, W.B. (Pennsylvania State Univ., University Park). pp 155-163 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

This paper describes the encapsulation strategy as applied to microscopic-scale encapsulation in ceramics composed of micron-sized grains of possibly more leachable radiophases intimately surrounded by micron-sized grains of more insoluble phases. The encapsulation approach should be valid, almost axiomatic, for defense waste. However, there are still problems to be investigated experimentally. These are (a) because of the dilution, it is difficult to confirm the geometry of the radionuclide-bearing phases relative to that of the matrix: one almost has to use the inverse approach by making leach measurements, (b) deciding between using the highly reactive oxyhydroxide sludges themselves or sintered calcine to be coated, (c) verification of the insolubility of the encapsulant phases in a variety of groundwaters, and (d) the production of ceramics of near-zero porosity, using hot-isostatic pressing, or incorporation in either silicate or phosphate cements.

207 **Treatment of cladding hulls by the HIPOW process.** Larker, H.T.; Tegman, R. (High-Pressure Lab., Robertsfors, Sweden). pp 209-218 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The conditions for densifying and bonding Zircaloy cladding hulls from spent LWR fuel to blocks by the HIPOW (hot isostatic pressing of waste) process have been studied. Fully dense and mechanically strong blocks of Zircaloy can be made without additives at temperatures around 1000°C. A volume reduction of about seven times and surface area reduction of more than 300 times, compared to typical loose-filled cladding hulls remaining after the chop-leach operations in a reprocessing plant, can be obtained. A study of a possible process for industrial scale has been made. Handling under water can prevent any fire hazard in the preparation sequence. The use of a special hermetically sealed double-wall metal container encasing the hulls during the densification in the hot isostatic press virtually eliminates the problem of lasting contamination of this equipment, thus greatly simplifying service and maintenance. One hot isostatic press can serve a reprocessing line with an LWR fuel capacity of 800 tons/year. Fines (residues) from fuel dissolution and alpha-contaminated ashes from incinerated organic materials in the plant may also be incorporated in the Zircaloy blocks. Tritium can quantitatively be contained in these blocks.

208 **Bituminization of low-level liquid waste.** Tokubuchi, T. (Kyushu Electric Power Co., Fukuoka, Japan); Kitajima, S.; Kuribayashi, H.; Yagi, T.; Kagawa, T. pp 219-226 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Penum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Solidification of radioactive wastes with bitumen has a number of preferable features compared with solidification with cement. Bituminization technology has been developed mainly in European countries such as West Germany, France and Belgium and some of the processes are in practical use at present in various countries of the world. In Japan, the first bituminization plant DRUM MIXER was constructed for the Japan Atomic Energy Research Institute (JAERI) by JGC Corporation in 1973. However, this plant was intended for the treatment of radioactive wastes from laboratories. Regarding wastes generated at commercial nuclear power plants, Kyushu Electric Power Co. has just started the operation of a facility for the bituminization of liquid waste from its PWRs by using the DRUM MIXER process. In Japan, besides these two DRUM MIXER plants presently in operation, three are under construction and two are on the drawing boards. In this paper the general features of the bituminization process are reviewed and the results of fundamental research work and actual operation of the DRUM MIXER are discussed.

209 **Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste.** Forberg, S. (Royal Inst. of Tech., Stockholm, Sweden); Westermark, T.; Faelth, L. pp 227-234 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Penum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

In Sweden, a system for transferring long-lived activities from organic to inorganic ion exchangers such as titanates and zeolites was demonstrated on a bench scale. The stability of this system depends on the conditioning of the inorganic ion exchangers. The purpose of this paper was to study and compare the quality of the products obtained by hot pressing and hot isostatic pressing in order to guide the choice of full scale equipment. Due to the leakage of argon, the hot isostatic pressing did not appear to have an advantage. The extremely large surfaces of authentic titanates must be ascribed to this phenomenon. The merits of the two sintering methods could not be objectively compared from the results obtained. Therefore, more experiments are needed and planned. These are studies on the conditioning of the titanates previous to the sintering, on the welding technique and performance, and at a higher sintering temperature, 1300°C, known to yield very good results. Formally, a leach rate of 3 $\mu g\ d^{-1}\ cm^{-2}$ for the zeolites corresponds to the leaching out of cesium from a surface layer of 0.15 cm during 300 years. The same leach rate of strontium from titanates corresponds to a depth of 0.08 cm for 300 years. Bearing in mind that the temperature of the deposit will be at least 80°C lower, and the water flow much lower, the examples mentioned here might be quite satisfying. After a more successful sintering, the leach rates may be still better and a leaching test at more realistic conditions might be worthwhile.

210 **Diffusion of cesium in concrete.** Andersson, K.; Torstenfelt, B.; Allard, B. (Chalmers Univ. of Tech., Goeteborg, Sweden). pp 235-242 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Penum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

A study of the sorption and diffusion of cesium and iodide in slag cement paste and concrete in different aqueous environments is described in this paper. The low diffusivity observed for cesium in slag cement implies that the mass transport rate of cesium through intact slag cement paste and concrete would be very low. Assuming a diffusivity of $10^{-13}$ m²/s it would take 3900 years before the concentration of cesium on one side of a 0.4 m thick concrete wall would reach 1% of the concentration on the other side. To reach 10% of the concentration it would take 9600 years, and for 50% over 50,000 years would be required. The choice of ballast would

have a large influence on the sorption and the mass transfer rate of cesium in concrete (an increase in retention, i.e., water velocity/nuclide velocity, by a factor of at least 10 seems feasible). The addition of suitable getters with high sorption of cesium, iodide or any other radionuclide might improve the already good properties of concrete as an encapsulation material for low and medium level radioactive waste furthermore. Thus, an intact concrete encapsulation or overpack in a waste repository constitutes an effective barrier in preventing the release of $^{137}Cs$ (half-life 30 y) into the groundwater.

211 **Melting process to condition decladding hulls generated by the reprocessing of LWR and FBR spent fuels.** Bonniaud, R.; Jacquet-Francillon, N.; Jouan, A.; Sombret, C. pp 267-274 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The fusion compaction of metallic waste from spent fuel hulls is shown to be easily feasible for both Zircaloy and for stainless steel, and volume reduction factors in the region of 5 to 7, corresponding to the theoretical density of the alloy obtained, are arrived at quite easily. The Zircaloy copper alloy, put into use to lower the fusion point of the Zircaloy, appears extremely interesting both as to the ease with which it can be used and the possibility which it offers of working at temperatures always lower than 1250°C. The decreasing of fusion temperature is less spectacular with stainless steel; only the use of silicon enabling the lowering of the temperature to around 1200°C appears really feasible. The use of decontaminating agents either during or at the end of the fusion operation seems to be a promising technique, especially in the case of stainless steel where the use of a borosilicated glass is easy. The choice of decontaminating agent is more difficult for Zircaloy which reduces the principal oxide components of glasses and makes necessary the use of molten salts mixtures, the composition of which has not yet been defined. The decontamination factors obtained during the tests run on steel are encouraging although they were obtained using artificially contaminated hulls; they should therefore be considered with precaution and be confirmed by further tests in hot cells using real hulls.

212 **Geochemical study of a lamprophyre dike near the WIPP site.** Brookins, D.G. (Univ. of New Mexico, Albuquerque). pp 307-313 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

To test the problem of possible elemental migration from dike into contact rock, composite samples of lamprophyre from close to the center of the dike and from the dike edge as well as polyhalite and anhydrite from the contact zones were analyzed by neutron activation analysis. However, halite-rich samples could not be analyzed with the facilities available due to irradiation-induced interference from sodium. Collectively the data argue for little if any chemical exchange between the lamprophyre and intruded evaporite sequence. This in turn implies that the brine (+- vapor) generated by melting induced by dike emplacement was more effective in causing alteration of the evaporite + clay mineral sequence near the dike as opposed to attack on the dike. Further, canister material (+- overpack) should remain relatively stable in the evaporites. Studies by others also show that evaporite melting and other metamorphic-metasomatic events to be restricted to the evaporite contact zone.

213 **Leach and corrosion tests under normal and accident conditions on cement products from simulated intermediate level evaporator concentrates.** Rudolph, G.; Vejmelka, P.; Koester, R. (Kernforschungszentrum Karlsruhe GmbH, Germany). pp 339-346 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Cesium leach tests at ambient temperature and pressure show that tap water, distilled water, and sodium chloride solutions cause no or only very slight corrosion of cemented evaporator concentrates prepared from various types of cement with or without various additives. Salt brine is very corrosive to cement products; the corrosion rate depends on the composition and cement type. Cesium leaching follows a diffusion controlled mechanism in distilled water, sodium chloride solution, and salt brine but only to the point where disintegration occurs. In tap water cesium leaching does not follow a single diffusion mechanism. Leach tests at elevated temperatures and pressures show that cesium leaching in salt brine for relatively short leach times is independent of preparation conditions and pressure but depends on the cement type. The corrosion resistance of cemented evaporator concentrates is better than that of salt-free cements.

214 **Influence of surface processes in waste form leaching.** Machiels, A.J.; Pescatore, C. (Univ. of Illinois, Urbana). pp 371-378 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

A leaching model incorporating bulk diffusion and surface processes is presented. The short-term leaching behavior of waste proposed model is qualitatively and semi-quantitatively consistent with available experimental leach data obtained at moderate temperatures and based on the behavior of alkali and alkaline earth radionuclides.

215 **Experimental evaluation of changes in properties of natural minerals under irradiation.** Spitsyn, V.I.; Balukova, V.D.; Kosareva, I.M.; Kabakchi, S.A. (USSR Academy of Sciences, Moscow). pp 429-433 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The present paper is concerned with a further study of the influence of irradiation on natural minerals, which constitute the storage medium for radioactive wastes. The influence of irradiation on the typical alumosilicate feldspar minerals microcline and oligoclase has been studied. The threshold registration doses of radiation effects were evaluated. The increased rate of supplied energy and optimum temperatures for storage in halite layers was determined for salt structures.

216 **Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete.** Allard, B.; Torstenfelt, B.; Andersson, K. (Chalmers Univ. of Tech., Goeteborg, Sweden). pp 465-472 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The investigation has shown that a significant retention of $H^{14}Co_3^-$ in a groundwater system may be expected in the presence of calcite- and calcium-containing materials. Higher distribution coefficients were obtained in the batch experiments than in the column experiments. Thus a lower flow rate would probably give a higher retention than what was observed in the present column experiments. In a potential waste repository the water flow rate would be low and calcite would be a common fracture mineral. Concrete and bentonite/quartz have been suggested as backfill materials in a repository. Concrete may be expected to retain a carbonate leakage completely, as long as the material is intact. Also a bentonite/quartz mixture would give a retention by at least a factor of 10. The $^{14}C$ exchange for inactive carbon is also of importance when using the $^{14}C$ method for groundwater dating. In the use of mathematical models for prediction of the carbon evolution in a groundwater system, a quantitative knowledge of possible sinks and sources of carbonate is required. The sorption of $^{14}C$ on solid surfaces constitutes a sink that will, if not considered in the age determination, lead to too high estimated ages. Both precipitation and weathering may change the $^{13}C/^{12}C$ ratio in the undisturbed groundwater. Thus, the role of calcium-containing media, particularly calcite, in the repository/bedrock system must be considered in assessing $^{14}Cd$ transport times from the repository to the bio-

sphere as well as in the interpretation of $^{14}C$ age determinations of groundwater.

217 **Development of structural engineered barriers for the long-term containment of nuclear waste.** Westerman, R.E. (Battelle Memorial Inst., Richland, WA). pp 515-522 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

A task directed toward the development of licensable engineered barrier systems for the long-term containment of high-level nuclear waste under conditions of deep geologic disposal has been underway at the Pacific Northwest Laboratory (PNL) since January 1979. Metallic, ceramic, and polymeric materials are being investigated by means of mechanical property and corrosion screening studies to determine the suitability of these materials for use as long-lived structural barriers, i.e., canister, overpack, and hole sleeve, in nuclear waste packages. At the present time the barrier program at PNL is primarily involved in conducting screening studies, though some in-depth investigations are underway, notably in the mechanical testing area. The actual status of the subtask work elements and the results obtained to date for the following are presented; mechanical property evaluation of metallic materials; corrosion evaluation of metallic materials; ceramic materials; and polymeric materials.

218 **Technical barriers against a contact of groundwater with disposed radioactive waste.** Uerpmann, E.P. (Gesellschaft fur Strahlen- und Umweltforschung, Braunschweig, Germany). pp 539-543 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

In conclusion, there may be no way of assuring with absolute certainty that water cannot contact the waste in a geological time frame. One must analyze scenarios which consider the possibility of the repository filling with water during or after storage even though there is only a very slight probability of such an event occurring. If a water break-in must be assumed, it would probably take place through a shaft, penetrating covering layers with groundwater. The shaft is generally considered the most vulnerable portion of a final repository, since here the water has its shortest path through the geological formations. For that reason, the greatest attention should be focused on a shaft design that is permanently and completely watertight. A mine layout is presented which is applicable to all different disposal concepts for radioactive waste, whether they utilize tunnels, dumping chambers, caverns, or emplacement boreholes. However, this may complicate the operational phase of the repository since the haulage ways become longer and the ventilation system may be more complex. Nevertheless, it provides an effective passive countermeasure against the flooding of the disposal tunnels. Also, it allows time for active postaccident countermeasures such as backfilling with slurries and grouts. If several barriers are placed in series, the escape of disposed nuclides requires a long time and the nuclides decay to harmless levels. Therefore, radioactive waste disposal within specially designed disposal sites in deep geologic formations is a sufficiently safe way to isolate radioactive waste.

219 **Highly compacted bentonite: a self-healing substance for nuclear waste isolation.** Pusch, R. (Univ. of Lulea, Sweden); Bergstroem, A. pp 553-560 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Granular Na bentonite acquires considerable microstructural homogeneity through water and particle redistribution processes. This yields a very low permeability and thus excellent barrier functions in repositories. This self-healing property also means that large bentonite volumes tend to reach a homogeneous condition. Thus, local voids or inhomogeneities produced, for instance, by minor displacement of the surrounding rock will be healed. The swelling potential also means that a perfect contact is established between the clay barrier and the rock.

220 **Iodine removal in the Purex reprocessing process.** Kaneko, H.; Muramoto, H.; Takeda, H.; Hoshino, T.; Segawa, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). pp 185-194 of Fast reactor fuel reprocessing. Proceedings of a symposium sponsored by the Society of Chemical Industry and held at UKAEA Dounreay Nuclear Power Development Establishment, 15-18 May 1979. London, England; Society of Chemical Industry (1980).

From Fast reactor fuel reprocessing symposium; Dounreay, UK (15 May 1979).

It is considered most practical to apply a modified Purex process to FBR spent fuel reprocessing. There are, however, many problems peculiar to FBR fuel to be solved and iodine removal is a very important one. The quantity of radioactive iodine in FBR spent fuel estimated by ORIGEN code is 120 Ci per metallic ton of fuel after 120 days cooling, and the amount of iodine element becomes about 800 grammes per ton of fuel when the reactor operation mode of the prototype FBR is simulated, postulating burn-up of 95,000 MWD/t. These values are several times as much as for LWR spent fuel. The most adequate system is considered to be release of the iodine as much as possible at the chemical head end step into the off-gas stream from which it is removed by an off-gas treatment system before distributing widely to each stage of reprocessing in various chemical forms. IODOX process is one method and is superior in removing organic iodine which cannot be removed by activated charcoal. IODOX process utilizes the strong oxidizing power of highly concentrated nitric acid, converting iodine to nonvolatile chemical forms, while the nitric acid can be reused and concentrated iodine can be obtained. To evaluate the IODOX process, the iodine behaviour in the dissolution system was examined and the quantity of iodine released to the off-gas was estimated. A packed column was constructed and the oxidation and absorption processes of iodine by concentrated nitric acid were examined in detail. Some tests were also undertaken on the iodine concentration and storage processes.

221 **Management of radioactive wastes in the United States of America.** Parker, F.L. (Vanderbilt Univ., Nashville, TN (USA)). pp 1001-1008 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The management of radioactive wastes in the USA is discussed in detail. After characterising the nature and quantity of waste generated by the commercial nuclear power programme and also by defence requirements, the resulting hazards are presented as a function of time up to $10^9$ years of storage. The present and proposed methods of managing the waste are reviewed and estimates of the temperature and surface rise for storage in basalt are presented. It is concluded that a firm national commitment is needed to resolve the issue and that it is essential to prove that the performance of mined repositories conforms to present predictions.

222 **Environmental monitoring and deep ocean disposal of packaged radioactive waste.** Mitchell, N.T.; Preston, A. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Fisheries Radiobiological Lab.). pp 1009-1013 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Environmental monitoring in the context of the dumping of packaged radioactive waste in the deep ocean is discussed in detail. The principles and objectives laid down by the IAEA and the ICRP are reviewed. Monitoring and its relationships to radiation exposure, research, control measures and public information are described. Finally, the actual practice in the UK of environmental monitoring is detailed for the measurable case of liquid wastes in coastal waters and also for package waste in deep oceans which has to be calculated. It is concluded that better mathematical models are needed to predict the dose to man and that more research into

oceanographic and biological transfer processes should be carried out.

223 **Legal provisions concerning the handling and disposal of radioactive waste in international and national law.** Bischof, W. (Goettingen Univ. (Germany, F.R.). Abt. Atomenergierecht). pp 994-997 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A short survey is given on the situation of international legislation concerning radioactive waste handling and disposal. There are special rules on the disposal of nuclear waste in a number of conventions (Geneva 1958, London 1972, Helsinki 1974, Paris 1974, Barcellone 1976) on the protection of the marine environment and of the high sea against pollutions. In 1974 and 1978, the International Atomic Energy Agency made further recommendations concerning radioactive wastes referred to in the London Convention. In 1977, the Organisation for Economic Cooperation and Development also set up within its Nuclear Energy Agency (NEA) a multilateral consultation and surveillance mechanism for the sea-dumping of radioactive waste. The NEA has since published recommendations on the sea-dumping of radioactive waste. In 1975, it was agreed to abide by the Antarctic Treaty of 1959 not to dispose any nuclear waste on the Antarctic Region. There is at present no absolute prohibition of radioactive waste disposal in outer space but the Member States of the United Nations are responsible for such activities. As regards national legislation, the legal provisions for 13 different countries on radioactive waste disposal are listed.

224 **Proceedings of the specialist meeting on decommissioning requirements in the design of nuclear facilities, Paris, March 17-19, 1980.** Paris, France; OECD (1980). vp. (CONF-800359—).

From NEA specialist meeting on decommissioning requirements in the design of nuclear facilities; Paris, France (17 Mar 1980).

Separate abstracts have been prepared for individual items within scope for inclusion in the Energy Data Base.

225 **Parametric study of the temperature differential across the wall of an underground storage vault for monitored storage of radioactive wastes.** Markandeya, S.G.; Saha, D.; Venkat Raj, V. (Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.). pp 811-819 of Proceedings of fourth national heat and mass transfer conference 1977 [held at Roorkee]. Meerut, India; Sarita Prakashan (1977).

From 4. national heat and mass transfer conference; Roorkee, India (21 Nov 1977).

Underground vaults with assured cooling are frequently used to provide monitored storage for radioactive wastes. Because of the large decay heat generation in the radioactive materials a detailed thermal analysis of these vaults is required. One parameter of particular importance is the temperature differential across the wall because of its ramifications on the structural design. A parametric study of the influence of various parameters, such as inside air temperature, heat generation in the wall, wall thickness and its properties, adjacent soil and its properties etc. on the temperature differential across the wall has been carried out. The results are discussed.

226 **(NP—2900750) High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state.** Gervers, J.H. (State Planning Council on Radioactive Waste Management, Washington, DC (USA)). [nd]. 43p. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585. Order Number DE82900750.

The recent expansion of the national screening program for potential high-level waste regulatory sites has increased the number of states involved in negotiations with the Department of Energy. The Department of Energy is encouraging these states and tribes to enter into written agreements to define their participation in DOE's site development activities. Agreements are intended to: establish groundrules for state involvement in Federal decision making; demonstrate publicly that procedures are in place for ensuring proper review of the health, safety, environmental, and socioeconomic impacts of the project; provide a mechanism for ensuring that technical evaluations are carried out; and establish a means to resolve conflicts. The purpose of this document is to assist the states and DOE in developing workable agreements which are appropriate to the unique circumstances of each state and the DOE program in that state. The provisions outlined span the early phases of site exploration and development up to and through the site characteristics process.

## 0530 Environmental Aspects

*REFER ALSO TO CITATION(S) 196, 197, 218, 238, 992, 993, 994, 1195*

227 **Combined fracture/porous media model for contaminant transport of radioactive ions.** Nuttall, H.E. (Univ. of New Mexico, Albuquerque); Ray, A.K. pp 577-590 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

A model, with an analytical solution, was developed to study the effects of combined fracture and porous media flow on the migration rate of radioactive nuclides. The objective is to determine the degree of enhanced migration due to a thin fracture within the otherwise homogeneous porous medium. The geological waste disposal zone is treated as an infinite two-dimensional medium consisting of a narrow channel surrounded by a flowing aquifer. The top and bottom of the zone are assumed to be bounded by impermeable clays. The two-dimensional convective-dispersion equations, with a line source have been solved giving analytical expressions for the contaminant concentration, flux and total discharge rate downstream of the source. The total discharge rate of nuclides downstream of the pulse source has been calculated and compared with the results for ion migration in a homogeneous porous medium.

228 **Evaluation of the ability to predict radionuclide transport in groundwater flow systems.** Schwartz, F.W. (Univ. of Alberta, Edmonton); Smith, L. pp 599-605 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Two major differences exist between the model described here and those commonly used in practice. First, macroscopic or large-scale dispersion is accounted for as a mixing process caused primarily by heterogeneities in hydraulic conductivity. The conventional approach assumes that macroscopic dispersion can be approximated as a large-scale diffusion process. Second, the model operates as a stochastic simulator. The parameters of the porous medium which control transport are specified as statistical distributions rather than as a uniquely defined set of values. The results of the two sets of simulations demonstrate the potential applicability of this modeling concept. Even from the brief analysis presented here, it is apparent that the certainty with which transport predictions can be made will depend upon the characteristics of the system being modeled, the errors involved in estimating the statistical parameters describing the porous medium and the availability of known values of hydraulic conductivity. The implication of these and similar results from our ongoing studies is that certain kinds of groundwater systems may be more amenable to predictive analysis than others. The results of the simulations also show how sensitive the pattern of mass transport is to the spatial variation in hydraulic parmeters. Thus, even when relatively large quantities of information are available about the porous medium, it appears that predictions still can be uncertain. We conclude that more research on the origin and factors controlling prediction uncertainty is essential to the wide-spread application of modeling techniques.

229 **Uranium mining development in the Northern Territory: an overview of the issues.** Harris, S. (Australian National Univ., Canberra. Centre for Resource and Environmental Studies). pp 1-11 of Social and environmental choice. The impact of uranium mining in the Northern Territory. Harris, S. (ed.). Canberra, Australia; Australian National University (1980).

The author considers the issues raised by the decision of the Australian Government to approve the mining of uranium in the Alligator Rivers Region. These issues are associated with both the physical environment and factors of a social nature. A compromise needs to be reached between the various objectives - the mining interest, the minimum feasible disturbance of the Aboriginal society and culture, the needs of the Kakadu National Park, the reconciliation of white and Aboriginal Australian relationships and the protection of the natural environment.

230 **Mining and the natural environment: water and the dispersion of pollutants.** Young, P. (Australian National Univ., Canberra. Centre for Resource and Environmental Studies). pp 25-46 of Social and environmental choice. The impact of uranium mining in the Northern Territory. Harris, S. (ed.). Canberra, Australia; Australian National University (1980).

The author briefly outlines the main environmental features of the Alligator Rivers Region and then considers those aspects of the hydrology of the Magela drainage system which appear most pertinent to the problem of assessing the impact of uranium mining on the Region. Experiments undertaken to assess the transportation and dispersion properties of the rivers and streams in the area are described.

231 **Migration of radionuclides following shallow land burial.** Sedlet, J.; Golchert, N.W. (Argonne National Lab., IL (USA)). pp 240-243 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A summary is presented of a study of radionuclide migration conducted at a facility used from 1944 to 1949 for shallow land burial of radioactive waste, which was produced during operations with two nuclear reactors and related nuclear research. The study was begun in 1974, following the detection of tritiated water in two picnic wells north of the facility, between the burial plot and the river. The results indicated that tritium is migrating out of the site as tritiated water, but that no other radionuclides have left the plot. Potential pathways for exposure are considered and doses estimated. It is suggested that the source is neutron-irradiated lithium.

232 **Proceedings of the groundwater pollution conference, Perth, Western Australia, Feburary 19-23, 1979.** Lawrence, C.R.; Hughes, R.J. (eds.). Canberra, Australia; Australian Government Publishing Service (1980). vp. (CONF-790270—).

From Groundwater pollution conference; Perth, Australia (19 Feb 1979).

Separate abstracts are presented for each of the conference papers included in the data base.

233 **Effects of uranium mining of ground water in Ambrosia Lake area, New Mexico.** Kelly, T.E.; Link, R.L.; Schipper, M.R. (Geohydrology Associates, Inc., Albuquerque, NM). *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 313-319(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

The principal ore-bearing zone in the Ambrosia Lake area of the Grants uranium district is the Westwater Canyon Member of the Morrison Formation (Jurassic). This unit is also one of the major artesian aquifers in the region. Significant declines in the potentiometric lead within the aquifer have been recorded, although cones of depression do not appear to have spread laterally more than a few miles. Loss of potentiometric head in the Westwater Canyon Member has resulted in the interformational migration of ground water along fault zones from overlying aquifers of Cretaceous age. This migration has produced local deterioration in chemical quality of the ground water.

234 **Preliminary estimates of effects of uranium-mine dewatering on water levels, San Juan Basin.** Lyford, F.P. (Geological Survey, Albuquerque, NM); Frenzel, P.F.; Stone, W.J. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 320-333(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Most of the uranium mines in northwestern New Mexico will withdraw water from the Morrison Formation in the course of mining operations. Using three levels of projected uranium mining, a digital model was used to estimate approximate dewatering rates, effects on water levels in the Morrison Formation, and effects on streams to the year 2000. All effects are superimposed on other likely developments of ground water from the Morrison Formation. Planned or announced mines, a maximum of 33 by 1985, would produce 570,000 acre ft (7 x $10^8$ $m^3$) of water by 2000. The dewatering rate would be about 36 $ft^3/s$ (1 $m^3/s$) in about 1985, with drawdowns of 2,000 ft (600 m) or more expected near the deepest mines. By 2000, a projected medium range of development of 72 mines would produce about 1,300,000 acre ft (16 x $10^8$ $m^3$) of water, and the dewatering rate would be about 90 $ft^3/s$ (2.6 $m^3/s$). Drawdowns of 4,000 ft (1,200 m) or more might be expected near the deepest mines. By 2000, a maximum projected development of 105 mines would probably produce about 2,030,000 acre ft (25 x $10^8$ $m^3$) of water, and the dewatering rate would be about 117 $ft^3/s$ (3.3 $m^3/s$). By 2000, dewatering of uranium mines and other ground-water developments may reduce flow in the San Juan River by 0.04 $ft^3/s$ (0.001 $m^3/s$), and flow towrd the Rio Grande valley may be reduced by 0.5 $ft^3/s$ (0.015 $m^3/s$). The peak effect on flow to streams would not occur until long after the year 2000.

235 **Scientific advances and community risk. Proceedings of a meeting of the Science and Industry Forum of the Australian Academy of Science, held on October 6-7, 1978.** White, F. (ed.). Canberra, Australia; Australian Academy of Science (1979). vp. (CONF-7810261—).

From Meeting of the science and industry forum of the Australian Academy of Science; Canberra, Australia (6 Oct 1978).

Separate abstracts are presented for each of the conference papers included in the data base.

## 0540 Health And Safety

*REFER ALSO TO CITATION(S) 196, 197, 215, 218, 224, 227, 228, 869, 870, 1221*

236 (EUR—6629, pp 383-406) **Study of devices for the non destructive examination of drums containing low activity waste by neutron transport and gamma radiation codes.** Bosser, R.; Fiche, C. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). 1979. (In French). Dep. NTIS (US Sales Only).

From International meeting on monitoring of Pu-contaminated waste; Ispra, Italy (25 Sep 1979).

A limited parametric study was undertaken to analyse the phenomena occurring in the models of a device for determining the amount of plutonium contained in drums of low activity waste. The determinations consist in detecting the spontaneous fission neutrons emitted by the wastes or the delayed neutrons emitted by such waste previously activated by a fission neutron source. The parameters studied were the density of the hydrogenated substances in the waste, the quantity and geometry of the moderators of the detection unit and the spectrum of the neutrons emitted. The calculation tool used in this case was the APPOLO single dimension neutron transport code, normally employed in the CEA for the core physics of thermal neutron reactors. Despite experiments not always suitable for a single dimension analysis, worthwhile results were achieved which showed the value of such calculations in understanding the interaction of the various parameters in order to avoid systematics errors in the use of the aggregated determination results.

237 (EUR—6813(Vol.2), pp 811-818) **Passive γ-ray monitoring of plutonium contaminated waste.** Asghar, M.; Bondar, L. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

A passive γ-ray system based on a Ge(Li) detector has been set up to test the methods for monitoring Pu contaminated wastes. Point sources were used to obtain the detector parameters and measurements with ring γ-ray sources in a cylindrical matrix were executed to test the radiation transport model.

238 **Analysis on the use of engineered barriers for geologic isolation of spent fuel.** Cloninger, M.O. (Pacific Northwest Lab., Richland, WA). pp 607-614 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Results are completed in considerable detail for a reference salt site repository and in somewhat less detail for reference granite, basalt and shale systems. Based on those results, the following conclusions were reached: In nearly all cases, the regional geology is the most effective barrier to release of radionuclides to the biosphere, however, for long-lived isotopes of carbon, technetium and iodine, which were poorly sorbed on the geologic media, the geology is not very effective once a leach incident is initiated. While the need for, and the effectiveness of, a release-rate limiting barrier function is somewhat dependent on the sorption properties of the geologic media, generally a release rate of less than $10^{-3}$ $yr^{-1}$ is necessary to reduce the potential dose from 14C, 99Tc, and 129I to a baseline level below that of the actinides, and beyond that, a rate of less than $10^{-5}$ is required before the potential dose from the actinide chains can be further lowered by this mechanism. Only in extreme cases of the intrusion water well scenario is there a direct relationship between release rate from the repository and release to the biosphere. Generally, the delay in leach initiation that an engineered delay function might provide, $10^4$ years or less, is insufficient to accomplish any maximum potential dose reduction. Only the delay provided by a dry, stable geology, $10^5$ years or more can accomplish this. However, in the extreme and very unlikely case of the water well scenario the maximum potential dose is optimally reduced by a containment function lasting about 400 years. Primary nuclides of concern, in no particular order are 99Tc, 129I, 14C, 226Ra + daughters (U), 237Np (Am, Np) 234U, and for the extreme case of the well scenario, 90Sr.

239 **Hazards to the health of uranium workers and the regional population.** Kerr, C. (Sydney Univ. (Australia). Dept. of Preventative and Social Medicine). pp 108-121 of Social and environmental choice. The impact of uranium mining in the Northern Territory. Harris, S. (ed.). Canberra, Australia; Australian National University (1980).

In his paper on the hazards to the health of miners and the local population in the Alligator Rivers Region the author considers the Rangers Inquiry's second report. This made recommendations on which are based most of the current occupational health and safety practices in the Region. He suggests that the Inquiry should have stressed more the need for regulating safe practices and should have given relatively less emphasis to the potential problems of radiological hazards. Radiation protection standards and practices are discussed and the contents of the Australian Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores summarised.

240 **Absorption of dose rate in great bitumen blocks. Experimental detection.** Patek, P.R.M. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Forschungszentrum). pp 1014-1018 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A description is given of experimental measurements of the absorbed dose rate in bitumen blocks containing radioactive waste. Although bitumen embedding techniques are currently limited in specific activity content to a maximum of 1 Ci/l, higher activities are used in the experiment to accelerate the decomposition of bitumen due to radiation damage. Coated particles of sup(134,137)Cs and $^{90}Sr$ were used and problems encountered in measuring the beta and gamma radiation doses are described in detail. It is planned to simulate an absorbed dose of $10^8$ rad in 160 days (i.e. equivalent to about 300 years storage) and to also investigate the leaching behaviour of a bitumen-salt mixture.

## 0550 Regulations

*REFER ALSO TO CITATION(S) 180, 223, 612*

241 **(NP—2900894) Recommendations on national radioactive waste management policies: report to the President.** (State Planning Council on Radioactive Waste Management, Washington, DC (USA)). 1981. 67p. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585. Order Number DE82900894.

The State Planning Council on Radioactive Waste Management was established under Executive Order No. 12192 to provide advice and recommendations on ways of resolving specific institutional issues related to the management of radioactive wastes. With this report, the Council fulfills its mandate and offers recommendations which draw on the traditions of our federal system of government and could create an environment in which waste management decisions can be carried out. The Council's proposals reject the alternatives of either an arbitrary imposition of decisions by the Federal government of arbitrary actions by state, local, or tribal governments to block waste management activities. Instead, we call for a decision making process, invoking the principles of federalism, as the means to achieve the nation's radioactive waste management objectives. Of primary importance is the need for Congress to enact legislation that establishes a national policy for the permanent disposal of all high-level and transuranic wastes. This legislation should specify an intergovernmental decision making process based on the principles of consultation and concurrence. Unless this national policy, and the institutional framework to achieve it, is enacted into law we will not be able to regain public confidence in our nation's ability to safely manage and dispose of these wastes. In addition to our recommendations on high-level waste, the Council is calling for actions to be taken now to carry our existing policies on low-level waste disposal, the transportation of radioactive wastes, and the mangement of spent nuclear fuel. Clear national policies, consistently maintained and cooperatively implemented, are essential if our nation is to continue to enjoy the benefits of nuclear technology which both public and private organizations have brought to us.

242 **(NP—2900891) Low-level radioactive waste management: a regional compact.** Peery, R.J. (Southern States Energy Board, Atlanta, GA (USA)). [nd]. 22p. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585. Order Number DE82900891.

With the passage of the Low-Level Radioactive Waste Policy Act (Public Law 96-573), Congress authorized and encouraged the states to enter into interstate compacts for the purpose of managing low level radioactive waste. The purpose of this compact is to provide a framework for negotiating states to use in their development of final compact language. This draft compact is intended to be broad in scope and not overly specific. It must be kept in mind that the purpose of an interstate compact is to establish certain legal rights and responsibilities while not precluding actions which might otherwise be proper and necessary. This compact provides various alternative provisions under each article. Each article of the compact is followed by a short explanation of the article's purpose. Following the article's introduction are alternative paragraphs for consideration as specific language.

# 06 FUSION FUELS

## 0604 Transport And Storage

243 (INIS-mf—6447, pp vp) **Risk assessment applied to transportation of tritiated heavy water.** Dicke, G.J. (Ontario Hydro (Canada)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

# 07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

## 0701 Physical Isotope Separation

*REFER ALSO TO CITATION(S) 1461*

244 (AECL—7056, pp 240-264) **Distributed systems in the heavy water plant environment.** Galpin, J.V.; Kean, G.E.; McCardle, J.C. (Atomic Energy of Canada Ltd., Ottawa, Ontario. Commercial Products). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

This paper describes the data acquisition system on the Atomic Energy of Canada Limited, Glace Bay heavy water plant. After four years of successfull operation and frequent changes during this period in response to changing requirements the availability of the system has stabilized at 99 percent. The plant support group carry out all hardware and software maintenance. Based on the experience with this system consideration is being given to a computer control system for the plant. A distributed control system structure appears to be well suited to the heavy water plant requirements.

245 **Need for accurate deuterium analysis in a heavy water plant and its achievement.** Singh, R.R.; Pradhan, D.G. (Department of Atomic Energy, Talcher (India), Heavy Water Project). pp 97-101 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

Importance of Mass Spectrometer as an analytical tool for deuterium analysis in heavy water plants is discussed. Some of the important requirements such as memory effect and $H_3^+$ correction are described with reference to the Mass Spectrometer used at HWP (Talcher). For achieving the accuracy required, use of international deuterium standards and error estimation found by intercalibration are discussed.

246 **Mass spectrometers as an analytical tool in heavy water production.** Kapoor, S.; Dass, C. (Department of Atomic Energy, Kota (India)). pp 107-113 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

Different processes employed in the production of heavy water are enumerated, giving detailed account of the nature and source of samples, the D content of which have to be analysed. A mass spectrometric system employed for this purpose is described. Procedures developed for the analysis of D content in various hydrogen compounds are also included.

## 0702 Radiation Sources

247 (KFTI—79-65, pp 83-85) **Device for the low-temperature electron irradiation.** Petrusenko, Yu.T.; Karnaukhov, I.M.; Martynov, A.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

In Radiation damage physics and radiation technology.

A setup has been described for investigating the primary processes of the radiation liability or damageability of metals and alloys. The setup permits to carry out electronic radiation, annealing, and resistometric measurements of samples within the temperature range of 6 to 320 K. As a source of electrons, used is a pulse electronic gun having the accelerating voltage of about 30 kV, pulse duration of 2 ms, and the emission frequency of about 50 Hz. All the processes of specimen irradiation, annealing and measurement are carried into effect in a helium cryostat having a common vacuum with the electronic gun. The data of the investigation carried out into the kinetics of storing up the radiation defects in aluminium during the low-temperature (about 6 K) irradiation by electrons prove a high sensibility, good working capacity of the setup in examining the radiation damageability of metals.

# 09 OTHER SYNTHETIC AND NATURAL FUELS

## 0901 Hydrocarbon Fuels

248 **Methanation of carbon dioxide over a ruthenium catalyst for AGR gas circuit composition control.** Gliddon, B.J.; Haigh, C.P.; Hotchkiss, R.C.; Roberts, R.A. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). pp 262-270 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Some of the methane added to the carbon dioxide AGR coolant to inhibit graphite oxidation is decomposed in the reactor circuit so a continuous supply of 'make' gas is required. This is generated on-site by reacting pure hydrogen from an electrolysis plant with carbon dioxide, from bulk storage tanks, over a ruthenium-on-alumina catalyst. This methane is compressed and added to the circuit gas. Laboratory experiments to establish the performance characteristics of methanation units are described in this paper. The two designs of converter installed on AGR stations both comprise tubes packed with ruthenium-on-alumina catalyst with external cooling to control the strongly exothermic reaction. Methanation is achieved in two stages - the water vapour produced in the first stage is removed to perturb the equilibrium and to thereby enhance the conversion efficiency. The laboratory experiments reported were designed to yield reaction kinetic data relevant to conditions obtained in power station control plant.

## 0904 Solid Waste And Wood Fuels

*REFER ALSO TO CITATION(S) 982*

# 13 HYDRO ENERGY

## 1302 Site Geology And Meteorology

249 (INIS-mf—6422, pp vp) **Radiometric survey of water dam areas in the Beskydy Mountains.** Jirkovsky, R. (Vysoka Skola Banska, Ostrava (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

# 14 SOLAR ENERGY

*REFER ALSO TO CITATION(S) 641, 642*

## 1405 Solar Energy Conversion

*REFER ALSO TO CITATION(S) 260, 261*

**250 High efficiency silicon cells for luminescent solar concentrators.** Garner, C.M.; Sexton, F.W.; Nasby, R.D. (Sandia National Labs., Albuquerque, NM). *Solar Cells;* **4**: No. 1, 37-46(Aug 1981).

Energy conversion efficiencies of 18% and 19.4% at 0.1 W $cm^{-2}$ and 1 W $cm^{-2}$, respectively, were measured for a luminescent solar concentrator cell under an air mass one solar spectrum. This cell was designed for operation under illumination of 600 nm wavelength and 1 W $cm^{-2}$. From these results and spectral response data an efficiency of 26% can be projected for illumination at 600 nm. This agrees well with computer code calculations of 28%. The substrate doping level, cell grid pattern, minority carrier lifetime and antireflection coating properties were studied to optimize the cell performance for 600 nm and longer wavelengths.

**251 Properties of amorphous hyrogenated silicon, with special emphasis on preparation by sputtering.** Paul, W.; Anderson, D.A. (Harvard Univ., Cambridge). *Solar Energy Materials;* **5**: No. 3, 229-316(Sep 1981).

The properties of amorphous hydrogenated silicon are reviewed, with special emphasis placed on results obtained by the method of reactive sputtering in an argon-hydrogen plasma. The subjects treated include characteristics of the sputtering method; structural characterizational methods; determination of the hydrogen bonding configurations and the hydrogen content by several different techniques; trends in optical and electrical properties as a function of the substrate temperature and hydrogen partial pressure used in the preparation; the determination of the density of states in the energy gap by spin resonance, light induced spin resonance, photoemission, field effect, capacitance methods, deep level transient spectroscopy and tunneling spectroscopy; electrical transport, especially as modified by the existence of structural and chemical inhomogeneity; optical absorption near and below the optical absorption edge; photoluminescence as a function of photon energy, temperature, excitation photon energy and intensity; time-domain spectroscopy; and photoconductivity, both steady state and transient. Throughout the discussion an attempt is made to relate the results on a-Si:H prepared by the several methods now current to those of the particular sputtering technique emphasized. 226 references.

**252 Principles of photoelectrochemical, solar energy conversion.** Butler, M.A.; Ginley, D.S. (Sandia Labs., Albuquerque, NM). *Journal of Materials Science;* **15**: 1-19(1980).

Photoelectrochemical devices for conversion of solar energy into both electrical energy and chemical energy are discussed with emphasis on how the various material properties of the photoactive electrodes influence device efficiency and stability. The similarity between photoelectrochemical cells (PECs) and solid state devices is used to model their behavior and optimize such parameters as band gap, doping level, minority carrier lifetime, etc. A model is presented which calculates the electron affinity of any semiconductor and allows the prediction of the open circuit voltage of wet phototvoltaic cells and optimum biasing for chemical producing cells. The effects of absorbed ions at the semiconductor/electrolyte interface are reviewed. The temperature dependence of the energy levels in the semiconductor and the electrolyte are considered and the implications of these results to operation of PECs at elevated temperature are discussed. The major differences between PECs and solid state devices are the stability considerations. The thermodynamics of this problem is discussed. Other important degradation mechanisms and some solutions to these problems are reviewed. Finally, a prognosis of the future of this field is presented.

**253 Introduction to photovoltaics: physics, materials and technology.** Kazmerski, L. (Solar Energy Research Institute, Golden, CO). pp 489-549 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

The generic junction-type solar cell makeup is briefly described, and the hierarchy of parts of a photovoltaic system (solar cells, modules, arrays, array fields, and full systems) is given. The history of photovoltaics is briefly reviewed. Two systems for classifying photovoltaic devices are given: according to the macro- and micro-structure or degree of perfection of the materials used to make the solar cell (single crystal, polycrystalline, or amorphous); or according to the method of junction formation (homojunction, heterojunction, Schottky barrier, MIS, SIS, or electrochemical cells). The need for materials/device research to reduce cost is discussed. Using the homojunction as an example, the device physics of solar cells is described, the equivalent circuit is given, and the device efficiency is discussed. The basic requirements for photovoltaic materials are discussed. Properties considered include: the energy gap of the absorbing layer, absorption coefficient, carrier diffusion length, minority carrier lifetime, doping levels, surface recombination, and the density of gap states. Some examples are cited of device and materials engineering. A listing is provided of solar cells according to device configuration, and including information about crystallinity of the materials, energy gap, open-circuit voltage, short-circuit current, fill-factor, conversion efficiency, illumination, and antireflective coating. 302 references. (LEW)

**254 Research and device problems in photovoltaics.** Kazmerski, L. (Solar Energy Research Institute, Golden, CO). pp 551-584 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Some current photovoltaic research problems are reviewed, relating technical barriers and probable areas of future work. Attention is directed toward the status and problems of a pair of technologies that have the predicted application potential discussed in the previous chapter (3): intermediate-efficiency, thin-film solar cells (including amorphous and polycrystalline Si, GaAs, CdS-based devices, and some emerging materials) and high-efficiency, concentrator devices of both multijunction and multidevice types. Throughout this overview, the problems associated with the major defect in the polycrystalline device - the grain boundary - are emphasized, both in terms of the effects of these regions upon device performance and also in terms of research into circumventing the limits they place on efficient photovoltaic conversion. In addition, the importance of research into the detection of device/materials degradation mechanisms is stressed. 96 references.

**255 Heterojunctions for thin film solar cells.** Bube, R.H. (Stanford Univ., CA). pp 585-618 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

After a brief description of each of the 5 basic types of semiconductor junction systems (homojunction, heterojunction, buried homojunction, Schottky barrier, and MIS and SIS junctions), an overview is presented of the various properties that are significant in determining the performance of a typical heterojunction solar cell, the types of measurements. The properties considered include: the bulk properties of the component materials such as purity, carrier type and density, carrier mobility, minority carrier lifetime and diffusion length, and absorption constant as a function of photon energy; crystallographic structure and orientation; effects of surface treatment; contact resistivities; dark and light I-V measurements; light diode parameters; spectral dependence of quantum efficiency; reverse breakdown voltage; junction capacitance measurements; EBIC; photoluminescence and electroluminescence; chemical composition across the junction, physical and structural properties of the interface. Typical heterojunction band diagrams are explained, and numerous specific heterojunction solar cells are discussed including: CdS/CdTe; CdS/InP; oxide/semiconductor; ZnO/CdTe; MIS and SIS devices; and sputtered ITO/CdTe and ITO/InP junctions. (LEW)

**256 Optimization of solar conversion devices.** Ginley, D.S.; Butler, M.A.; Seager, C.H. (Sandia Labs., Albuquerque, NM). pp 619-664 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

The direct and indirect application of simple chemical potential and electronegativity arguments to two diverse systems is discussed. First it is shown how the key criteria of photoelectrochemical cells can be delineated. Particular attention is directed toward understanding the biasing requirements of these cells, and an electronegativity model is presented that can be used

to quantitatively predict biasing requirements. The importance of chemisorbed ions from the electrolyte on the Helmholtz layer is discussed. It is shown how the electromigration of ions in the electrode near-surface region can substantially affect biasing requirements and long-term stability of such photoelectrodes. In the context of polycrystalline silicon solar cells, the current picture of the energy levels in silicon grain boundaries is presented, and the double depletion layer, thermal-emission model of conduction over the potential barrier in the boundary is briefly discussed. Recent results demonstrating that various chemical agents, when appropriately introduced into silicon grain boundaries, are capable of modifying grain boundary potential barriers. Prospects for increasing polycrystalline silicon solar cell performance by these treatments are reviewed. 40 references. (LEW)

257 **Introduction to basic aspects of plasma-deposited amorphous semiconductor alloys in photovoltaic conversion.** Griffith, R.W. (Brookhaven National Lab., Upton, NY). pp 665-731 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Progress is reviewed that has been made in advancing an understanding of the materials properties of plasma-deposited a-Si:H. The nature of the plasma is discussed, proceeding from the preliminar concepts of the rf glow discharge to a more detailed description of the plasma chemistry in the silane glow discharge. Experience with plasma etching is briefly reviewed. Emitting reactive species are discussed that are identified in plasma deposition using optical emission spectroscopy, and electron-impact processes are summarized that are pertinent to the silane glow discharge. The characterization of plasma-deposited slicon-hydrogen alloys is discussed. Chemical bonding is introduced, including discussions on short-range structural order, the role of hydrogen in the alloy, and the influence of residual gap states upon diode characteristics. The dilemma of efficient doping but reduced minority-carrier transport is explored. The effects of nitroge and oxygen impurities are discussed with regard to: the optoelectronic properties of a-Si:H; and the photovoltaic conversion efficiencies of diagnostic devices that are fabricated using such materials. Anomolous behavior in photoconductivity is discussed. 75 references. (LEW)

## 1407 Solar Thermal Power Systems

258 **Heat engine requirements for advanced solar thermal power systems.** Jaffe, L.D.; Pham, H.Q. (JPL, Pasadena, CA). *SAE (Society of Automotive Engineers) Preprint;* No. 810454, 8(Feb 1981).

A power conversion subsystem consisting of an engine, an alternator, and auxiliaries is an important portion of most parabolic dish solar thermal power systems. Requirements and constraints have been established for such power conversion subsystems in the post-1985 time frame on the basis of expected needs of commercial parabolic dish power systems. To be competitive with conventional power systems, solar thermal systems using dish concentrators will need power conversion subsystems rated at less than 40 kW, with a net efficiency of 40 percent at full power and 37 percent at half-power. 4 refs.

## 1409 Solar Thermal Utilization

*REFER ALSO TO CITATION(S) 270*

## 1410 Solar Collectors And Concentrators

*REFER ALSO TO CITATION(S) 258*

259 **(NASA-CASE-MFS—23999-1) Solar tracking system.** White, P.R.; Scott, D.R. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Apr 1981. 6p. Avail: US Patent and Trademark Office.

A solar tracker for a solar collector is described in detail. The collector is angularly oriented by a motor wherein the outputs of two side-by-side photodetectors are discriminated as to three ranges: a first corresponding to a low light or darkness condition a second corresponding to light intensity lying in an intermediate range and a third corresponding to light above an intermediate range, direct sunlight. The first output drives the motor to a selected maximum easterly angular position the second enables the motor to be driven westerly at the Earth rotational rate and the third output, the separate outputs of the two photodetectors, differentially controls the direction of rotation of the motor to effect actual tracking of the Sun. Official Gazette of the U.S. Patent and Trademark Office

260 **Solar Materials Science.** Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980). 798p. (DOE/TIC—1030778). Academic Press, Inc., 111 Fifth Avenue, New York, New York 10003.

Separate abstracts were prepared for 19 chapters in this book. Two other chapters present problems and their solutions. (LEW)

261 **Introduction to Solar Materials Science.** Claassen, R.S. (Sandia Labs., Albuquerque, NM); Butler, B.L. pp 3-51 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Examples are given to illustrate the central importance of materials development in the solar energy program, and the challenges to the materials community are indicated. A general framework is provided in which materials development can be considered, starting with emphasis on performance life, and cost, and ending with recommendations for systems studies prior to expending effort on materials development. Optical elements are discussed which are common to both thermal and quantum conversion processes. Examples of problems in conversion processes are identified. (LEW)

262 **Optical properties-microstructure relationship in particulate media: optical tailoring of solar absorbers.** Ignatiev, A. (Univ. of Houston, TX). pp 151-170 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Afer a review of the basic principles of electromagnetic radiation absorption by a medium, the relationship between optical response and microscopic structure is examined in some detail. Two models are presented: the effective medium theory by Maxwell Garnett which ignores dynamic characteristics of the incoming wave, and the spheroid model of O'Neill and Ignatiev. Optical tailoring of a particulate absorber is discussed. (LEW)

263 **Solar mirror materials: their properties and uses in solar concentrating collectors.** Pettit, R.B.; Roth, E.P. (Sandia Labs., Albuquerque, NM). pp 171-197 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

The current state of mirror materials is reviewed with application to solar concentrators. After specular reflectance is defined, the optical measurement techniques developed specifically for these materials are discussed. Next, the solar reflectance properties of mirror materials, divided into categories of glass, metallized plastics, polished aluminum, and protective coatings, are summarized. Finally, current problem areas and future areas of research are discussed.

264 **Effect of soiling on solar mirrors and techniques used to maintain high reflectivity.** Roth, E.P.; Pettit, R.B. (Sandia Labs., Albuquerque, NM). pp 199-227 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

In order to establish a data base for the reflectance loss of exposed mirrors, a field test study was initiated simulating some of the operational configurations of solar mirrors. This includes long term soil accumulation studies on mirrors exposed to natural weathering, cleaning cycle tests, and experiments on the effect of the orientation angle of mirrors. Measurements were performed on a set of solar mirrors exposed to natural weathering for a period of 5 weeks to determine the wavelength dependent scattering by the particulates and the effect of the dust on the beam shape of the scattered light. A theoretical study is presented of the detailed scattering of light by particles, including extinction coefficient and an-

gular scattering functions, and loss in the specular reflection component. The deposition and adhesion of particles on a mirror surface is discussed. Representative mirror materials have been exposed to accelerated dust deposition in a low-velocity wind tunnel equipped with a dust infector/disperser unit and laser optical systems capable of monitoring the flux rate of the incident particles and the real-time reflectance loss of the exposed mirrors. Four cleaning strategies are discussed - prevention of settling, removal of dirt before chemical or mechanical bonding can occur, washing off dirt with active cleaning techniques capable of breaking bonds and modification of the surface to prevent bonding. (LEW)

265 **Emissivity of metals.** Sievers, A.J. (Cornell Univ., Ithaca, NY). pp 229-254 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Some early radiant heat transfer models of metals are discussed, and it is shown what is wrong with them. Some physical insight is provided into a new model, which does correctly describe the temperature dependent thermal radiative properties of metals. The spectral and total emissivities of metals are discussed. The model considers the metal as a free electron gas but accounts for the properties of metal surfaces. (LEW)

266 **Fundamental limits to the spectral selectivity of composite materials.** Sievers, A.J. (Cornell Univ., Ithaca, NY). pp 255-276 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

The spectrally selective characteristics of transparent heat mirrors, such as tin oxide, with and without conducting micromeshes, and of dark mirrors (absorbing layer in contact with infrared mirror) are examined. Dark mirror configurations considered include metal plus dielectric film and metal plus absorbing film. Findings for heat mirrors and dark mirrors are compared, and dark mirrors are found to have the most potential for intermediate temperature weakly-focusing solar thermal systems. (LEW)

267 **Composite film selective-absorbers.** Buhrman, R.A.; Craighead, H.G. (Cornell Univ., Ithaca, NY). pp 277-317 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

The general physical and optical properties of composite metal/dielectric films are discussed. This discussion is largely based on the findings of recent experiments with vacuum deposited films but it is also generally relevant to the understanding of electroplated coatings. Some general guidelines are presented for producing high performance absorber-mirror tandems for particular photothermal applications. Finally some recent developments in producing high performance selective absorbers for high temperature applications are reviewed.

### 1420 Heat Storage

*REFER ALSO TO CITATION(S) 260, 819*

268 **Thermal storage in salt-hydrates.** Telkes, M. (AEC Research Institute, Killeen, TX). pp 377-404 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Physical properties of salt-hydrates are reviewed as they relate to thermal storage. Topics covered include: melting and recrystallization; supercooling; nucleation or crystal seeding; rate of crystal growth; rate of heat removal from a crystalizing melt;calculation of the heat of fusion from heats of solution or from entropies of fusion; and calorimetric measurements and data. Properties of several selected salt-hydrates are discussed. 68 references. (LEW)

269 **Thermodynamic basis for selecting heat storage materials.** Telkes, M. (AEC Research Institute, Killeen, TX). pp 405-437 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

The theoretical basis for estimating heat of fusion values is briefly surveyed, and the heat of fusion and entropy of fusion are given for the elements through uranium. A method of calculating the heat of fusion is outlined and validated against data for numerous compounds particularly chlorides, fluorides and oxides. (LEW)

270 **Application of reversible chemical reactions to solar thermal energy systems.** Mar, R. (Sandia Labs., Livermore, CA). pp 439-457 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Thermochemical heat storage and transport and chemical heat pumping are reviewed in order to introduce the reader to the use of reversible chemical reactions in solar energy systems. The characteristic features of reversible chemical reaction systems are described and compared to sensible and latent heat systems. The different uses of reversible chemical reactions in solar energy applications are reviewed and their potential impact (i.e., economic viability) is appraised. Materials science issues are discussed which are relevant to the development of thermochemical schemes.

## 15 GEOTHERMAL ENERGY

### 1504 Legal And Institutional Aspects

*REFER ALSO TO CITATION(S) 271, 272*

### 1506 Environmental Aspects And Waste Disposal

*REFER ALSO TO CITATION(S) 271, 272*

### 1508 Geothermal Power Plants

271 **(P—800-81-003) USGS and Engineering and Environmental Division joint compliance monitoring report for Sacramento, CA Municipal Utility District's SMUDGEO No. 1 Geothermal project. Appendix D to final decision.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 25 Mar 1981. 69p. California Energy Commission, Sacramento, CA. Order Number DE82900592.

The laws, ordinances, standards, and conditions for designing, constructing, and operating the power plant and related facilities are referenced. In addition, actions, verifications, submittals, and approvals required by the USGS, BLM, and CEC are specified to assure that the facilities are designed, constructed, and operated in compliance with air and water quality, public health and safety, environmental and such other laws, ordinances, and standards specified. (MHR)

272 **(P—800-81-005) Compliance plan for PG and E geysers unit 16.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Mar 1981. 60p. California Energy Commission, Sacramento, CA. Order Number DE82900595.

A plan is described to establish a monitoring system to assure that the geothermal power plant is constructed and operated in compliance with air and water quality, public health and safety, and other applicable regulations, guidelines, and conditions of the California Energy Commission. The plan is divided into: a Power Plant Compliance Plan and a Transmission Line Compliance Plan. (MHR)

## 17 WIND ENERGY

273 **(GPO—56-735) Wind energy systems act of 1980.** (Committee on Science and Technology (U.S. Congress. House), Washington, DC Subcommittee on Energy Research, Development and Demonstration (Fossil Fuels)). 1980. 432p. Avail: Subcommittee on Energy Development and Applications.

The establishment of a 7 year $1 billion accelerated research and development program for windpower utilization is discussed. The goals of the legislation are to make wind energy cost competitive with conventional energy sources and to have in place at the end of the 7 year program 100 megawatts of wind machine capacity. At least 5 megawatts of the total would be for small wind machines.

# 20 ELECTRIC POWER ENGINEERING

## 2001 Power Plants And Power Generation

274 (AECL—7056, pp 198-213) **Design concepts and experience in the application of distributed computing to the control of large CEGB power plant.** Wallace, J.N. (Central Electricity Generating Board, Bristol (UK)). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

With the ever increasing price of fossil fuels it became obvious during the 1970's that Pembroke Power Station (4 x 500MW oil fired) and Didcot Power Station (4 x 500MW coal fired) were going to operate flexibly with many units two-shifting frequently. The region was also expecting to refurbish nuclear plant in the 1980's. Based on previous experience with mini-computers, the region initiated a research/development programme aimed at refitting Pembroke and Didcot using distrubuted computer techniques that were also broadly applicable to nuclear plant. Major schemes have now been implemented at Pembroke and Didcot for plant condition monitoring, control and display. All computers on two units at each station are now functional with a third unit currently being set to work. This paper aims to outline the generic technical aspects of these schemes, describe the implementation strategy adopted and develop some thoughts on nuclear power plant applications.

## 2002 Environmental Aspects

*REFER ALSO TO CITATION(S) 983, 984, 985, 1005*

## 2003 Power Transmission And Distribution

275 **Distribution-system planning using mixed-integer programming.** Gonen, T.; Foote, B.L. (Univ of Okla, Norman). *IEE (Institution of Electrical Engineers) Proceedings, Part C: Generation, Transmission and Distribution;* **128**: No. 2, 70-79(Mar 1981).

The prime objective of the study was to develop distribution-system planning models which can be used to determine optimum expansion patterns or alternatives by selecting optimum substation locations, i.e., sites, optimum substation expansions, optimum substation transformer sizes, optimum load transfers between substations and demand centers, and optimum feeder routes and sizes to supply the given loads, i.e., demands, subject to a number of constraints, to minimize the present worth of the total costs involved. The results indicate that the developed optimization models can be valuable tools in planning distribution systems. 15 refs.

# 21 NUCLEAR POWER PLANTS

## 2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

*REFER ALSO TO CITATION(S) 431, 526, 535, 572, 573, 574, 575, 576, 577, 578, 600*

276 (AECL—7056, pp 180-191) **Condensate clean up control system with distributed DDC.** Yoshioka, K.; Tazima, T.; Nakamura, O. (Toshiba Corporation, Tokyo (Japan)); Kobayashi, S. (Waseda Univ., Tokyo (Japan). Dept. of Physics). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

In the operation of the Condensate Clean Up System in BWR plants, regeneration intervals of the demineralizer are not equal and there is no base to determine the interval, which is usually decided by operator's experience. Regeneration of resin is, therefore, sometimes performed too early, leaving much of the capacity of the resin unused. In order to improve such operations efforts were made to equalize the operating time difference of two sequential demineralizers, to control the initial flow into newly-connected demineralizers. The economic and efficient operation of this system, along with the reduction of radioactive resins and the safety supervisory function can be achieved by the distributed DDC with a microprocessor.

277 (IWGFPT—8, pp 9-13) **Pellet-clad interaction observations in boiling water reactor fuel elements.** Sahoo, K.C.; Bahl, J.K.; Sivaramakrishnan, K.S.; Roy, P.R. (Bhabha Atomic Research Centre, Bombay (India). Radiometallurgy Section). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

Under a program to assess the performance of fuel elements of Tarapur Atomic Power Station, post-irradiation examination has been carried out on 18 fuel elements in the first phase. Pellet-clad mechanical interaction behavior in 14 elements with varying burnup and irradiation history has been studied using eddy current testing technique. The data has been analysed to evaluate the role of pellet-clad mechanical interaction in PCI/SCC failure in power reactor operating conditions.

278 (IWGFPT—8, pp 41-47) **Pellet-cladding interactions. Detection and location of PCI defects through fission product release during reactor operation/transients and the concept of cumulative PCI damage.** Venkateswarlu, K.S.; Naik, M.C.; Narasimhan, S.V.; Paul, A.R.; Venkateswaran, G. (Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The laboratory experiments on PCI have clearly shown the extent of clad thinning that could happen when the pellet contacts the Zircaloy clad because of $UO_2$ swelling. The stresses that are developed as a result of the growth of the interfacial layers can easily cause clad fracture. The fission gas release from the core of a BWR has been used to detect and locate the defective fuel elements caused by PCI. The absence of memory effects for the PCI shocks as revealed under the in-reactor conditions and the rapidity of $UO_2$-Zircaloy-2 interaction as shown by the laboratory experiments go to prove that the PCI failures occur during a single fuel cycle of operation and that it is not a gradual process.

279 (IWGFPT—8, pp 71-78) **Operation with monosequences in ASEA-ATOM BWR. A way of reducing the impact of PCI.** Olsson, S. (ASEA-ATOM AB, Vaesteraas (Sweden)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The energy loss due to PCI restrictions for a start-up after refuelling (or after sequence exchange) is about 18 EFPH (Effective Full Power Hours). All ASEA-ATOM BWRs are equipped with fine motion control rod drives (FMCRD), which makes it possible to withdraw control rods at full power in acceptably small steps (1.8 cm) from the PCI point of view. Thus burnup compensation can always be done without any energy loss due to PCI-restrictions. The ASEA-ATOM PCI-related operating restrictions are described and their implication on the operations of an ASEA-ATOM BWR is discussed. It was shown how the energy generation losses due to PCI-restrictions could be reduced to a minimum, by proper use of continuous motion screw-type control rod drives and high-capacity recirculation pumps, together with advanced use of burnable absorber, and refined refuelling schemes. Monosequence Operation (MSO) has reduced energy generation losses due to PCI-restrictions from about 1% to about 0.4%. MSO has been in routine use in Swedish BWRs since 1977 and during 1980 the fourteenth successful MSO-cycle has been completed.

280 (KURRI-TR—179, pp 28-31) **Released rare gas and its hold-up in nuclear power plant.** Nishikawa, M. (Japan Atomic Power Co., Tsuruga, Fukui. Tsuruga Power Station). 1978. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on the state of natural radioactivities in the environment; Kumatori, Osaka, Japan (22 Mar 1978).

Rare gas leaks from fuel pins to coolant when the fuel claddings lose the integrity in nuclear power plants. As for the routes of release, the rare gas in coolant is transferred to steam turbines,

and released to the atmosphere through the air ejectors for condensers, the shaft sealing steam system for turbines and the active carbon type hold-up device. The other route of rare gas release to the atmosphere is due to the leakage of steam and coolant through the ventilation systems for turbine buildings, reactor buildings and radioactive waste treatment buildings. These release routes of rare gas are shown, utilizing the example of a BWR plant. The rare gas hold-up system which was installed in the Tsuruga Nuclear Power Station is explained. The principle of the hold-up of rare gas is the decay of radioactivity during the repeated absorption in and separation from charcoal bed of rare gas. The decay effect is given by an exponential type formula. Radioactive rare gas consists of about twenty kinds of the isotopes of Xe and Kr. The decay curves for Xe and Kr are shown. The specifications of the rare gas hold-up system are shown.

281 **Mixing zone analysis for river plumes.** Paily, P.P. (Ga Inst of Technol, Atlanta). *Journal of the Environmental Engineering Division, ASCE (American Society of Civil Engineers);* **107**: No. 4, 731-746(Aug 1981).

Steam power plants which utilize once-through cooling, are required to meet certain mixing zone standards for thermal plumes. Once-through cooling occurs when water is withdrawn from a natural river or lake, and heated water is returned to the same, after condenser circulation. Compliance with regulatory standards during plant operation is often verified from field measurements at specified time intervals. Field data from thermal plume surveys can be used to develop mixing zone models. These are useful in establishing the necessary operating criteria that will assure compliance with the standards during plant operation over the specified range of river flows. A case study is presented illustrating the development of mixing zone models, and the application of such models to evaluate the possible operating criteria for a nuclear power plant at low river flows. 13 refs.

282 **Study of transient air injection into a pool of water.** Dhir, V.K.; Catton, I. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). pp 651-665 of Transient two-phase flow. Proceedings of the second CSNI specialists meeting, Paris, 12-14 June 1978. Vol. 2. Reocreux, M.; Katz, G. (eds.). Paris, France; Commissariat a l'Energie Atomique (Feb 1981).

From Meeting on transient two-phase flow; Paris, France (12 Jun 1978).

Experiments have been conducted to study the hydrodynamic phenomena associated with the transient injection of air into a pool of water through single and double vent tubes placed in an axisymmetric vessel. The effect of such geometric parameters as submergence depth, distance of vent exit from the bottom of the test chamber, and the ratio of the cross-sectional area of the tube to that of the test chamber has been studied for single tubes. The data show that the bottom maximum pressure increases with submergence depth and that two-dimensional effects start to play a role at submergence depths of about 20 cm (test chamber diameter = 45 cm). The minimum downward force is observed to occur when the momentum of the expanding bubble is at its maximum. The double vent data show that a superposition principle will tend to overestimate the maximum downward force, while a reduction in cell size will reduce the magnitude of the local maximum and tend to make the pressure uniform over the bottom of the test chamber. Prediction of the maximum average downward force for double vents is found to be possible from single vent observations if the single vent is assumed to be placed in between the double vents and if it has a cross-sectional area equal to the sum of the areas of the two vents. A comparison of predictions based on the present work with the experimentally observed forces in a 1/5th scale Mark I BWR torus has been made.

283 **Computer controlled nondestructive testing on the irradiated fuel rod.** Ohuchi, A.; Matsushima, Y.; Tsukui, K. (Nippon Nuclear Fuel Development Co., Ltd.). pp 103-108 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The precise fuel rod driving machine for the nondestructive testing, which has been in mock-up test of the analog data-acquisition for three years, was modified for the data-acquisition and for the data-processing of diameter measurement, eddy-current testing and gamma scanning of the fuel rod from the current BWR. These modifications consist of conversion of analog data to a digital pulse train and of desk-top computer controlling of the data-acquisition/-processing.

284 **Some Windscale experience of the underwater examination of water reactor fuel assemblies.** Banks, D.A.; Prestwood, J.; Stuttard, A. (UKAEA Windscale Nuclear Power Development Labs.). pp 181-185 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Windscale Nuclear Laboratories have been involved in the underwater post irradiation examination of irradiated water reactor fuel since the early 1970's. Since the work of the laboratories covers a wide range of fuel types, the equipment has had to be capable of handling any design, long or short, circular or square. There has so far been no element of routine work in the tasks performed at Windscale, for in this period fuel assemblies from 9 LWR's and WSGHWR have been examined successfully. Individual jobs have ranged from visual examination which may be carried out at several magnifications, to the complete breakdown of a PWR assembly to its separate rods and grids. Between these limits rod bow and rod diameter have been measured, rod withdrawal forces determined, and eddy current test methods devised. Cutting equipment has been used for a variety of dismantling tasks, and underwater cameras have been employed for monochrome and colour photography, using standard and macro lenses. The equipment is described.

285 **Analytical procedures using instruments in the post-irradiation examination of fuels.** Ohuchi, A. (Nippon Nuclear Fuel Development Co. Ltd. (Japan)). pp 356 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

286 **Shielding data requirement for thermal power reactors of boiling water and gas cooled type.** Hehn, G.; Kicherer, G. (Stuttgart Univ. (TH) (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). pp 89-108 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

The assessment of data requirements for reactor shielding have been extended to a modern BWR-plant (KRB II, 1300 MWsub(e) at Gundremmingen) as well as to high temperature gas cooled reactor (THTR-300,300 MWsub(e) at Uentrop). The sensitivity studies of the light water reactor were performed for the radial shield configuration with the EURLIB group structure. Together with a previous investigation of a shielding benchmark problem for a PWR plant we established a priority list of data improvements needed for LWR shielding. The uncertainties presently given in the high energy part of the neutron fission spectrum as well as for the inelastic cross sections of stainless steel and for some foil activation data don't meet the high safety requirements of pressure vessel loading. Reasonable large dimensions are given for the radial shield of the pebble bed reactor with prestressed concrete pressure vessel. Here upscatter of thermal neutrons have to be treated by several thermal groups to get the gamma production and gamma heating correctly. The uncertainty analysis is performed for water and graphite in EURLIB structure and for iron in the twentysix group information available.

287 **Fabrication of burnable poison fuel pellets for TAPS - plant experience.** Balakrishna, P.; Narayanan, P.S.A.; Somayajulu, G.V.S.R.K.; Sinha, K.K. (Nuclear Fuel Complex, Hyderabad (India)). pp 401-421 of Proceedings of the symposium on sintering and sintered products [held at] Bombay, October 29-31, 1979. Bombay, India; Department of Atomic Energy (1980).

From Symposium on sintering and sintered products; Bombay, India (29 Oct 1979).

The burnable poison gadolinium oxide has been incorporated in the reload fuels of Tarapur reactors. In each fuel assembly of 36 elements, two elements contain $UO_2Gd_2O_3$ pellets. The problems faced in their fabrication and the solutions evolved have been summarised in the paper.

288 **Experimental study of pipe reaction force and jet impingement load at the pipe break.** Kitade, K.; Nakatogawa, T. (Mitsubishi Atomic Power Industries, Inc., Taitoku, Tokyo (Japan). Engineering Center); Nishikawa, H.; Kawanishi, K.; Tsuruto, C. (Mitsubishi Heavy Industries Ltd., Takasago, Hyogo (Japan). Takasago Technical Inst.). pp F6/2 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In the design of a light-water reactor nuclear power plant, the extreme loads which are caused as the result of hypothetical pipe break accident have recently become the most severe factors for the structure and equipment design of the plant. In this paper, we describe the results of experiments about reaction forces and jet impingement loads in the pipe break accident conditions. Experiments were carried out for the kinds of jets, that is steam jet and subcooled water jet.

## 2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

*REFER ALSO TO CITATION(S) 284, 288, 431, 524, 528, 534, 538, 557, 560, 562, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591*

289 (EUR—6813(Vol.1), pp 407-428) **Dosimetry experiment 'Dompac'. Neutronic simulation of the thickness of a PWR pressure vessel. Irradiation damage characterization.** Alberman, A.; Faure, M.; Thierry, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services des Piles); Hoclet, O.; Le Dieu de Ville, A.; Nimal, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Etudes des Reacteurs et de Mathematiques Appliquees); Soulat, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Recherches Metallurgiques Appliquees). 1980. (In French). Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

For suitable extrapolation of irradiated PWR ferritic steel results, proper irradiation of the pressure vessel has been 'simulated' in test reactor. For this purpose, a huge steel block (20 cm in depth) was loaded with Saclay's graphite (GAMIN) and tungsten damage detectors. Core-block water gap was optimized through spectrum indexes method, by ANISN and SABINE codes so that spectrum in 1/4 thickness matches with ANISN computations for PWR Fessenheim 1. A good experimental agreement is found with calculated dpa damage gradient. 3D Monte Carlo computation (TRIPOLI) was performed on the DOMPAC device, and spectrum indexes evolution was found consistent with experimental results. Surveillance rigs behind a 'thermal shield' were also simulated, including damage and activation monitors. Dosimetry results give an order of magnitude of accuracies involved in projecting steel sample embrittlement to the pressure vessel.

290 (EUR—6813(Vol.1), pp 429-436) **Importance of flux calculations and dosimetry in PWR vessel surveillance programs.** Buchalet, C.B. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The beltline region of a reactor vessel includes the parts which surround the nuclear core and is subjected to neutron bombardment, resulting in a degradation of the material toughness. The degradation of the material toughness is monitored during the life of the reactor through a surveillance program, the validity of which is based greatly on the accuracy of flux calculations and dosimetry measurements. These aspects are presented in this paper for a typical FRAMATOME 900 MWe reactor.

291 (EUR—6813(Vol.1), pp 482-492) **Pressure vessel surveillance experience in Belgian power plants.** van Asbroeck, P.; Tourwe, H.; van de Velde, J.; Gubel, P.; de Regge, P. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The experience gained up to now by C.E.N.-S.C.K., in the characterization of the irradiation conditions and in the characterization of the sample is given, methods of characterization and results are specified. The sources of error, inaccuracy and uncertainty in the process and in the determination of the characteristics are underlined and actions taken in order to avoid them are described.

292 (EUR—6813(Vol.1), pp 501-509) **Status of radiation embrittlement trend curve data base re-evaluation.** Wullaert, R.A.; McConnell, P. (Fracture Control Corp., Goleta, CA (USA)); Oldfield, W. (Materials Research and Computer Simulation, Goleta, CA (USA)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The primary goals of reevaluation of irradiated data base are to obtain, update, and qualify the existing mechanical property, chemical composition, and irradiation history data for irradiated pressure vessel steels, and to develop a weighting procedure whereby the 'quality' of the radiation damage data is systematically assessed in order to develop statistically-weighted data bounds.

293 (EUR—6813(Vol.2), pp 858-864) **Neutron emission observed from spent thermal reactor fuel assemblies.** Gold, R.; Ruddy, F.H.; Lippincott, E.P.; McElroy, W.N.; Roberts, J.H. (Hanford Engineering Development Lab., Richland, WA (USA)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

A scoping experiment to characterize the neutron field generated from a Light Water Reactor spent fuel assembly has been successfully completed. Solid State Track Recorder (SSTR) neutron dosimeters have been exposed at the surface of a spent fuel assembly from a Pressurized Water Reactor. Acceptable track densities were obtained. From these SSTR neutron dosimetry observations, an absolute neutron flux of roughly 800n/($cm^2$.sec) was obtained at the surface of the spent fuel assembly three years after discharge. The deduced neutron energy spectrum, with a mean neutron energy of roughly 1.3 MeV, is intimately dependent upon the actinide content of the spent fuel. Hence, the results of this preliminary experiment have demonstrated that, with suitable calibration, SSTR neutron dosimetry can be successfully applied for non-destructive spent fuel actinide assay and for characterization of the radiation environment associated with spent reactor fuel assemblies.

294 (EUR—6813(Vol.2), pp 865-872) **Post irradiation analysis of high burn-up light water reactor fuel elements.** Guardini, S.; Guzzi, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The results of a set of destructive post-irradiation measurements on LWR fuel elements with high burn-up are presented.

The data are analyzed and discussed with the aid of the Isotope Correlation Technique and Passive Neutron Emission Evaluation.

295 (EUR—6813(Vol.2), pp 919-927) **Benchmark referencing of neutron dosimetry measurements.** Eisenhauer, C.M.; Grundl, J.A.; Gilliam, D.M.; McGarry, E.D.; Spiegel, V. (National Bureau of Standards, Washington, DC (USA)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The concept of benchmark referencing involves interpretation of dosimetry measurements in applied neutron fields in terms of similar measurements in benchmark fields whose neutron spectra and intensity are well known. The main advantage of benchmark referencing is that it minimizes or eliminates many types of experimental uncertainties such as those associated with absolute detection efficiencies and cross sections. In this paper we consider the cavity external to the pressure vessel of a power reactor as an example of an applied field. The pressure vessel cavity is an accessible location for exploratory dosimetry measurements aimed at understanding embrittlement of pressure vessel steel. Comparisons with calculated predictions of neutron fluence and spectra in the cavity provide a valuable check of the computational methods used to estimate pressure vessel safety margins for pressure vessel lifetimes.

296 (EUR—6813(Vol.2), pp 928-936) **Review of ANS special session on radiation streaming in power reactors.** Lee, R.R. (Combustion Engineering, Inc., Windsor, CT (USA)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

This review is limited to a summary of the computational techniques used to predict the radiation environment and establish the shield effectiveness of proposed shield designs for pressurized water reactors. The use of measured data to determine accuracy of computer models is also covered. Several shield designs for pressurized water reactors as well as design techniques for proper orientation and shielding of large penetration in boiling water reactors were also reported in this special session.

297 (INIS-mf—6447, pp vp) **Experimental investigation of release mechanisms responsible for airborne contamination seen during post-transport underwater unloading of a failed PWR spent fuel assembly.** Klingensmith, R.W. (Battelle Columbus Labs., OH (USA)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

298 (IWGFPT—7, pp 168-172) **Theorical study and modelling of fuel cladding interaction and stress corrosion concerning the light water reactor fuel elements.** Senot, J.; Stora, J.P. (Electricite de France, 75 - Paris). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

In the light water reactors, cladding fractures happening during power ramps, are supposed to take their origin in the stress cracking corrosion physico-chemical mechanism. Using the actual theorical knowledges on pellet-clad interaction we modelized this phenomenon in the case of light water reactors. This modelling should allow us to evaluate more precisely the relative influence of the different parameters and to interpretate actual or future experimental results concerning the PWR fuel behavior in power ramping conditions.

299 (IWGFPT—7, pp 173-179) **Effects of fission gas release on PWR fuel rod design and performance.** Leech, W.J.; Kaiser, R.S. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

The purpose of this investigation was to determine the effects of fission gas release on PWR fuel rod design and performance. Empirical models were developed from fission gas release data. Fission gas release during normal operation is a function of burnup. There is little additional fission gas release during anticipated transients. The empirical models were used to evaluate Westinghouse fuel rod designs. It was determined that fission gas release is not a limiting parameter for obtaining rod average burnups in the range of 50,000 to 60,000 MWD/MTU. Fission gas release during anticipated transients has a negligible effect on the margins to rod design limits.

300 (IWGFPT—7, pp 180-189) **Prediction of the optimum filling pressure for PWR fuel rods.** Baylis, C.C.; Howl, D.A.; Coucill, D.N. (British Nuclear Fuels Ltd., Springfields Works, Salwick, Preston, UK). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

The change to pressurized rods for PWR fuel has produced beneficial effects: less reduction in fuel-clad gap conductivity due to fission gas release and hence generally lower fuel temperatures, a delay in the closing of the fuel-clad gap and hence in the onset of pellet-clad interaction (PCI), and increased resistance to creep collapse in the clad. Calculations indicate however that the optimum filling pressure, chosen to produce the lowest fuel temperatures and fission gas release, is lower than that commonly used in PWR fuel. Thus a lower filling pressure could improve the performance of the fuel under loss of coolant accidents for example. The results of calculations made for a range of filling pressure using the HOTROD fuel performance code are described and discussed. It is demonstrated first that HOTROD gives predictions of fission gas release in good accord with observations for both pressurized and unpressurized fuel rods.

301 (IWGFPT—7, pp 210-216) **Predictions of the thermomechanical code RESTA compared with fuel element examinations after irradiation in the BR3 reactor.** Petitgrand, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service des Elements Combustibles et Structures). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A large number of fuel rods have been irradiated in the small power plant BR3. Many of them have been examined in hot cells after irradiation, giving thus valuable experimental information. On the other hand a thermomechanical code, named RESTA, has been developed by the CEA to describe and predict the behavior of a fuel pin in a PWR environment and in stationary conditions. The models used in that code derive chiefly from the CEA's own experience and are briefly reviewed in this paper. The comparison between prediction and experience has been performed for four power history classes: (1) moderate (average linear rating approximately equal to 20 kw $m^{-1}$) and short (approximately equal to 300 days) rating, (2) moderate (approximately equal to 20 kw $m^{-1}$) and long (approximately equal to 600 days) rating, (3) high (25-30 kw $m^{-1}$) and long (approximately equal to 600 days) rating, and (4) very high (30-40 kw $m^{-1}$) and long (approximately equal to 600 days) rating. Satisfactory agreement has been found between experimental and calculated results in all cases, concerning fuel structural change, fission gas release, pellet-clad interaction as well as clad permanent strain.

302 (IWGFPT—7, pp 235-244) **CONTACT 1 and 2 experiments: behavior of PWR fuel rod up to 15000 MWd.tu$^{-1}$.** Bruet, M.; Pointud, M.L. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)); Dodelier, J.; Melin, P.H. (Framatome, Lyon, France). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

In order to study the behaviour of 17x17 fuel rods, CEA and FRAMATOME have undertaken cooperative experiments. Some of them are called CONTACT 1 and CONTACT 2. In both experiments, a fuel rod with Zircaloy 4 cladding is irradiated in a pressurized water loop under 13 MPa. A power level 40 kW.$m^{-1}$ for CONTACT 1 and 25 kW.$m^{-1}$ for CONTACT 2 has been required. Each fuel rod is equipped with: a thermocouple in the center of the fuel; three pipes for the fission gases collection and measurement of pressure drop through the fuel stack; and a device with strain gauges in order to measure the evolution of the external

cladding diameter. Results concern the centerline temperature evolution, the fuel to cladding gap variations, and the kinetics of stable and radioactive fission gas release.

303 (IWGFPT—8, pp 13-18) **Review of the fuel failures in batch 8 fuel from the Haddam Neck Reactor.** Howl, D.A.; Raven, L.F. (British Nuclear Fuels Ltd., Salwick, Preston). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

During the third cycle of operation for Batch 8 fuel in the Haddam Neck Reactor a steady increase in the coolant activity was observed. At the end of the cycle the fuel was discharged and subjected to sipping and visual inspection. These operations confirmed that several of the Batch 8 Assemblies contained leaking fuel rods. The paper reviews the design and fabrication information and analyses the performance of the fuel rods under the operating conditions experienced. Conclusions are drawn as to the likely cause of failure and predictions are compared with measurements made on the fuel rods after discharge from the reactor.

304 (IWGFPT—8, pp 85-91) **Pressurized water reactor fuel duty during core operation.** Fici, J.A.; Kaiser, R.S.; Sipush, P.J. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

Pellet-clad interaction (PCI) is a mechanism which can potentially cause fuel rod defects in water cooled reactors. PCI failures have been observed in irradiated fuel during post-refueling startups and there is the potential for PCI during plant operational transients. The purpose of this paper is to quantify typical fuel duty during PWR plant operation with respect to the local effects of power, change in power and burnups. In addition, a comparison is made to fuel duty during significant control rod maneuvers in a US commercial plant. The fuel duty in a Westinghouse PWR core containing 17 x 17 fuel was studied analytically. Plant operational transients, such as load follow, were simulated at various times during a reactor cycle. As a result of this investigation, several important trends were identified and quantified. For example, during normal plant operation, the maximum local power prior to any load follow maneuver tended to decrease below 9.5 kW/ft for local burnups in excess of 20,000 MWD/MTU. Changes in local power during load follow exhibited a maximum for local burnups between 15,000 and 25,000 MWD/MTU. The paper discusses the fuel duty for pellets operating at low and high powers as a function of pre-transient local power and fuel burnup, during plant operational transients. To supplement the analytical results derived from this investigation, the fuel duty was evaluated during a control rod maneuver performed during a physics test program in a commercial reactor near the end of a cycle.

305 (IWGFPT—8, pp 128-141) **Pellet cladding interaction. Mechanical and chemical approach to modelling.** Atabek, R.; Chantant, M.; Pineira, T. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Joseph, J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

An important experimental irradiation programme has been pursued jointly by CEA and FRAMATOME during several years, aiming at the determination of the operating limits of a PWR rod during a ramp power. Besides the correlation between power failure threshold and burn-up, detailed post irradiation examinations have brought valuable information for modelling both mechanical and chemical processes occuring in the PCI phenomenon: (1) The mechanical process is evaluated by a code using a finite element method; a description of the code and a comparison between calculations and experimental data are presented. (2) The chemical process modelling is based on PIE qualitative and quantitative gamma-spectrometry carried out on ramped fuel rods sections, with particular consideration given to the analysis of the concentration of volatile fission products (I, Cs) at the definite locations where they have been observed.

306 (IWGFPT—8, pp 142-149) **Analytical interpretation of PCI related experiments.** Dehon, C.; Dodelier, J.; Joseph, J.; Bernard, Ph. (Framatome, Fuel Div., Lyon, France). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The results of analytical experiments carried out in cooperation with CEA will enable FRAMATOME to better model the interface between fuel pellet fragments and Zircaloy claddings during a power ramp. The pellet-to-cladding interaction forces, either due to pellet fragment relocation, fuel swelling and/or cladding creep-down, have been parametrically evaluated using the FRAMATOME 3D finite element code TITUS. This work has been done in preparation of the important PCI test program which will be carried out in 1981-1982 on FRAMATOME designed fuel rods pre-irradiated in power reactors and ramp tested in the CEA test reactors. In parallel, an extensive reactor core analysis program is being conducted to better define the limiting conditions to which the FRAMATOME fuel rods could be submitted during postulated transients on power reactors and to translate these limiting conditions in terms of adequate testing parameters.

307 **Detection of failed fuel rods in irradiated fuel assemblies.** Baro, G.; Scharpenberg, R.; Schuchmann, K.W. (Babcock - Brown Boveri Reaktor G.m.b.H., Mannheim (Germany, F.R.)); Pieper, K.; Gutmann, G. (Krautkraemer G.m.b.H., Koeln (Germany, F.R.)). pp 340 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

308 **Application of DUCKPOND to the OAK RIDGE PCA calculational blind test.** Hall, M.C.G.; McCracken, A.K.; Packwood, A. (UKAEA Atomic Energy Establishment, Winfrith). pp 145-156 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

The Pool Critical Assembly (PCA) at OAK Ridge was an experimental simulation of the shield and pressure-vessel regions of a Pressurised Water Reactor. Extensive measurements were carried out and laboratories were invited to calculate 'blind', ie without knowledge of the experimental results, various quantities throughout the shield. The Technical Letter for the PCA Blind Test published by the Nuclear Regulatory Commission stated: 'the Intent of the Blind Test is to assess current neutron transport theory methods as applied to the publication of neutron penetration in LWR water-steel environments ... The Calculations from the various participants will be compared with each other and with the best available measurements on the PCA benchmark'. Sensitivities to cross sections used in the calculation are derived for various reaction-rates in the middle of the simulated pressure-vessel and the influence of data uncertainties on the accuracy of calculation of the 58Ni(n,p)58Co reaction rate in the middle of the pressure vessel is calculated.

309 **Optimized reactor vessel utilizing large forged pieces.** Cambien, R.B. (Westinghouse Nuclear Europe, Brussels (Belgium)). pp 23-27 of Assuring structural integrity of steel reactor pressure vessels. Steele, L.E. (Naval Research Lab., Washington, DC (USA)); Stahlkopf, K.E. (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Systems and Materials Dept.) (eds.). London, England; Applied Science (1980).

From 1. international seminar on assuring structural integrity of steel reactor pressure vessels; Berlin, F.R. Germany (20 Aug 1979).

Current designs of reactor vessel for the Westinghouse Pressurised Water Reactors (WPWR) are constructed from forged rings or a combination of forged rings and rolled plates with contoured nozzle forgings welded into the nozzle shell course through the full thickness. In the case of plate construction, there will be up to three longitudinal welds in the nozzle shell course. A programme

has been undertaken to optimise the reactor vessel design starting with the initial concept of using only three major pieces, i.e., a single forged integral flange and nozzle shell course, one forging for the parallel vessel shell course and transition ring and a hemispherical bottom head. This basic concept has then been reviewed against 8 the interfacing needs of the system design, the vessel closure design and the manufacturing techniques for forgings.

310 **Probabilistic modelling of in-service examination of PWR type reactor pressure vessels.** Harrop, L.P. (UKAEA Atomic Energy Technical Unit, Harwell). pp 111-121 of Assuring structural integrity of steel reactor pressure vessels. Steele, L.E. (Naval Research Lab., Washington, DC (USA)); Stahlkopf, K.E. (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Systems and Materials Dept.) (eds.). London, England; Applied Science (1980).

From 1. international seminar on assuring structural integrity of steel reactor pressure vessels; Berlin, F.R. Germany (20 Aug 1979).

Recently, models have been developed which attempt to theoretically quantify the reliability of LWR reactor pressure vessels and piping. Few of these models have included a treatment of in-service examination, though they may have implicitly included the pre-service examination. The term examination is used here to describe the ultrasonic inspection procedures now used on steel reactor pressure vessels. These procedures are generally determined by national codes or regulations, notably for instance the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI. The timing and extent of examinations is an important part of these regulations. Here some results are described from a theoretical, probabilistic study of in-service examination. Work somewhat like this has appeared previously and some has evidently influenced the latest version of the relevant codes. The present study is compared and contrasted with this previous work and some comment made about the assumptions and restrictions of the theoretical approach to assessment of examination methods.

311 **Methods to determine the influence of quality assurance on the reliability of primary components of a PWR.** Schmitt, W.; Wellein, R. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 163-175 of Assuring structural integrity of steel reactor pressure vessels. Steele, L.E. (Naval Research Lab., Washington, DC (USA)); Stahlkopf, K.E. (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Systems and Materials Dept.) (eds.). London, England; Applied Science (1980).

From 1. international seminar on assuring structural integrity of steel reactor pressure vessels; Berlin, F.R. Germany (20 Aug 1979).

Two failure modes of two different primary components of a PWR are considered; brittle fracture of the reactor pressure vessel and leakage of the main coolant pipe. The influence of quality assurance on the reliability of these components is evaluated for the following cases: pre-service and in-service ultrasonic inspections, and pre-service and in-service hydro-tests. The influence of these different actions on the reliability is studied by comparing the estimated reliabilities with and without that action. This means that all results will be given in relative numbers. By introducing a detection probability of the ultrasonic inspection the effect on the initial defect distribution and thus on the reliability can be estimated. This effect on the reliability is strongly dependent on the shape of the assumed detection probability. Using that of the Marshall Report the failure probability of the component in question decreases by a factor of approximately 100. The influence of the hydro-test on the reliability turns out to be very dependent on the time passed since the test. Generally speaking the effect during the first years after the test is very considerable, whereas it strongly decreases for the time after that.

312 **Aspects of design integrity for preparation of rules and standards for nuclear power plants in the Czechoslovak Socialist Republic.** Havel, S.; Nechvatal, J.; Koutsky, J. (Nuclear Research Institute, (Czechoslovakia)). pp 187-192 of Assuring structural integrity of steel reactor pressure vessels. Steele, L.E. (Naval Research Lab., Washington, DC (USA)); Stahlkopf, K.E. (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Systems and Materials Dept.) (eds.). London, England; Applied Science (1980).

From 1. international seminar on assuring structural integrity of steel reactor pressure vessels; Berlin, F.R. Germany (20 Aug 1979).

Design integrity is one of the main preconditions for the assurance of the operational safety of pressure components of nuclear power plants. This chapter describes the main aspects of the preparation of rules and standards for the Czechoslovak nuclear power and nuclear machine industries. Czechoslovak policy is based on experience gained from the production and construction of nuclear power plants of Soviet type VVER. However, it draws on experiences and recommendations mentioned in the publications of the IAEA, and on the rules and standards of other countries. The chapter mentions the main general, technical and organizational aspects of the preparation of rules and standards for design integrity assurance of pressure components. Reference is also made to documents concerning the operational integrity of primary circuit components, which have already been adopted by some COMECON working authorities.

313 **Behaviour of fission products in PWR primary coolant and defected fuel rods evaluation.** Bourgeois, P.; Stora, J.P. (Electricite de France, 92 - Courbevoie). pp C1/1 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

The activity surveillance of the PWR primary coolant by $\gamma$ spectometry gives some informations on fuel failures. The activity of different nuclides e.g. Xenons, Kryptons, Iodines, can be correlated with the number of the defected fuel rods. Therefore the precharacterization with eventually a prelocalization of the related fuel assemblies direct the sipping-test and allows a saving of time during refueling. A model is proposed to calculate the number of the defected rods from the activity measurements of the primary coolant. A semi-empirical model of the release of the fission products has been built from the activity measurements of the primary coolant in a 900 MWe PWR. This model allows to calculate the number of the defected rods and also a typical parameter of the mean damage. Fission product release is described by three stages: release from uranium dioxide, transport across the gas gap and behaviour in the primary coolant.

314 **Verification of the resistance of PWR thermal sleeves to thermal fatigue.** Bosser, M.; Mercier, F. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 71 - Saint Marcel (France)); Amzallag, C. (Societe Creusot-Loire, 42 - Unieux (France). Centre de Recherche); Ponsot, J. (Societe Creusot-Loire, 71 - Le Creusot (France)). pp G8/2 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. G. Structural analysis of steel reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The spray and surge nozzles of a PWR pressurizer loop are submitted to thermal shocks when cold water is injected into the pressurizer. A sleeve protects the nozzles against these thermal shocks. This sleeve is connected to the nozzle end by a socket weld. This connection induces a notch effect. Stress analysis with conventional methods for studying components behaviour cannot be carried out near a notch, since there is no convenient criterion.

In order to find a solution to this problem, a method has been established to describe the fatigue behaviour of material near a notch considered as a singularity point. This report describes two phases of work undertook to establish and verify the applicability of this method to the analysis of thermal sleeves, and shows how it has been applied for the analysis of the surge nozzle. The first phase bears on the choice and qualification of a finite element mesh accurate enough to account for the stress field near the crack tip. The second phase is an experimental verification of the method through the testing of specimens especially designed to present the main features of the constitution of the thermal sleeves socket weld assembly.

315 **Structural analysis of a PWR vessel nozzle-to-hemisphere.** Lecarpentier, P. (Electricite de France, 92 - Paris-la-Defense); Bourrier, P. (Societe de Controle Technique et d'Expertise de Construction (SOCOTEC), 75 - Paris (France). Dept. Genie Industriel et Nucleaire); Millard, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques). pp G10/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. G. Structural analysis of steel reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The structural analysis of a PWR vessel hemispherical cover has been currently performed in the past. The purpose of the present study was to estimate, in a more accurate way, the stress concentrations which occur at the junction of a control rod nozzle to the hemispherical cover. The connection located at maximum slope, with reference to an horizontal axis, was selected for calculations, owing to most conservative assumptions. The study was restricted to the structure defined as follows. In a longitudinal direction, symmetry due to neighbouring part and radial symmetry led to two vertical limiting planes; in a meridional direction, the choice was directed by the qualitative results of a previous finite element analysis of an entire cover with holes, which showed that vertical planes surrounding the junction were translated as rigid bodies. Therefore, only one quarter of the nozzle, and the attached spherical part, were considered. The analysis was carried out using several finite element programmes of the CASTEM system built by the Commissariat a l'Energie Atomique.

316 **Design and construction of the prestressed concrete containments of the French standard 900 MWe PWR.** Bordet, R.; Costaz, J.L.; Laboudigue, J.F. (Electricite de France, 75 - Paris. Service Etudes et Projets Thermiques et Nucleaires). pp J1/6 (1) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

317 **Results of strength tests on a 1:10 model of reactor containment.** Donten, K.; Knauff, M.; Sadowski, A.; Scibac, W. (Politechnika Warszawska (Poland). Miedzyresortowy Inst.). pp J4/8 (1-6) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A 1:10 scale model of nuclear reactor containment was made of prestressed concrete using materials identical with those of the original structure, with all essential structural details. It was designed on the basis of the theory of thin shells of revolution.

318 **Experimental study of a spherical PWR-containment with geometrical imperfections at the welds.** Bornscheuer, F.W. (Stuttgart Univ. (TH) (Germany, F.R.). Inst. fuer Baustatik). pp J6/7 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

It is the purpose of the experimental investigation described in this paper to study the influence of the additional stresses caused by a mismatch of the shell plates which cannot be avoided in real structures. The spherical shell model had a diameter of 2.6 m and a thickness of 30 mm. The load was internal pressure. High strength steel St E 51 with a minimum yield limit of 500 N/mm$^2$ was used. At one circumferential weld the plates had intentionally a mismatch between 1.0 and 4.6 mm. At a second circumferential weld a heart-shaped imperfection (necking) was intentionally induced using the same welding conditions. The deviation of the regular shape was between 3.8 and 6.3 mm based on a measuring length of 500 mm. Unfavourable welding conditions were chosen. Some of the basic electrodes used were not dried before welding.

319 **Elasto-plastic analysis of nozzle intersections in reactor containments.** Saettele, J.M.; Ramm, E.; Bornscheuer, F.W. (Stuttgart Univ. (TH) (Germany, F.R.). Inst. fuer Baustatik). pp J6/9 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In this paper the elasto-plastic analysis of a nozzle intersection in a pressurized spherical reactor containment is presented. The study was performed for a model shell. Comparisons between different idealizations of the structure are given. The results are related to the usual design concept based on the corresponding codes.

320 **Vibration of PWR internals considering their edge conditions and holes.** Kuzelka, V. (Statni Vyzkumny Ustav pro Stavbu Stroju, Bechovice (Czechoslovakia)). pp F1/3 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlans; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In this paper the results of a study of the frequency modal characteristics of PWR core barrel models either without holes, either with the holes, both in air and in still water, are presented. Experimental studies of the influence of holes on the frequency spectra and on the values of damping coefficients in mentioned environments, and of the end seating behaviours were carried out. As far as the research in a fluid flow is concerned the results of an analysis of hydroelastic response of internals due to random excitations of a coolant flow and a built hydrodynamic equipment, which contains the gravitational channel of 36 m water column, are described.

321 **Vibration studies on a three-loop PWR internals model.** Assedo, R.; Castello, G. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Paris La Defense (France)); Epstein, A.; Gibert, R.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques); Baylac, G. (Electricite de France, 92 - Paris la Defense). pp F2/1 (4-6) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

During the last years, the vibration behaviour of a three-loop PWR internal structures with cylindrical thermal shield has been

studied on the SAFRAN 1 hydroelastic model. The new program, called SAFRAN 2, consists in studying the vibration behaviour of a new type of internals with partial shield (neutron pads). The experimental program is based essentially on a 1/8 scale hydroelastic mock-up representing the internal structures, core barrel, pads, baffles and formers. Harmonic tests in air were carried out on the model with several configurations of internal structures to characterize the effect of the different components on the vibration behaviour, i.e.: - Core barrel alone; - Core barrel with pads and without baffles and formers; - Core barrel with baffles and formers and without pads; - Complete internals, core barrel with pads, baffles and formers. Shaker tests were also undertaken on a full scale prototype internals at the manufacturer shop, in a same configuration of structures and with identical boundary conditions as on the model. There is a good agreement between the model and the prototype results (frequencies, mode shapes and damping ratio).

322 **Experimental and elastic-plastic numerical analysis of a PWR piping elbow subjected to pressure cycling.** Prost, J.P.; Doyen, J.J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Paris La Defense (France)); Foult, T. (Societe de Controle Technique et d'Expertise de Construction (SOCOTEC), 75 - Paris (France)); Jakubowicz, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques). pp F3/1 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper presents the results measured on the structure during the experiment and two inelastic computer analyses of this structure. The two calculations are conducted independently with two different computer codes. The first analysis is carried out with the MARC program and uses an isoparametric quadrilateral doubly-curved thin shell element. This element fulfils continuity requirements and represents rigid body modes exactly. The input data and the computed results are presented. The measured and computed values are compared. The second analysis is conducted with the TRICO program developed by the C.E.A. (French Atomic Energy Commission). This program uses a flat triangular constant strain thin shell element. The plastic analysis is made with the global method. The input data and the computed results are presented. The measured and computed values are compared. A study of the sensitivity of computed results to the material and geometrical data is conducted. It is found that the computed results are fairly good in view of the assumptions made on the input data for each calculation.

323 **Acoustic pressure pulsations in pressurized water reactors.** Cepkauskas, M.M. (Combustion Engineering, Inc., Windsor, CT (USA). C-E Power Systems Group). pp F4/2 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper is an examination of pressure pulsations within a PWR resulting from circulating pump excitations. Evaluation of these pulsations are necessary in determining the structural integrity of the reactor internals. Previously published solutions involving the coolant annulus were formulated by the use of an equivalent body force to circumvent the complexities of a time-dependent mixed-value boundary condition problem. However, due to divergent physical arguments concerning the correct form of the body force, different solutions were obtained. In addition these publications are based upon assumptions regarding the value of the inlet pressure (i.e. pressure at the inlet pipe/coolant annulus interface). This analysis addresses the following two problems: 1. Derivation of a theoretical solution that resolves discrepancies between varying physical arguments. 2. Analytical determination of the inlet pressure. The solution involves examination of two separate regions: 1. The inlet pipe which includes the pump, inlet pipe and inlet pipe/coolant annulus interface is described by a one-dimensional acoustic wave equation with time-dependent non-homogeneous boundary conditions. 2. The coolant annulus is described by a three-dimensional acoustic wave equation in cylindrical coordinates with a non-homogeneous boundary condition at the inlet pipe/coolant annulus interface. The remaining boundary conditions are assumed to be homogeneous.

324 **Vibration of three-dimensional piping subject to pump pulsation.** Keskinen, R. (Institute of Radiation Protection, Helsinki (Finland)). pp F4/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In this paper a method, based on a transfer matrix approach, is presented for determining the coupled pump pulsations and mechanical vibrations of nuclear piping in steady state. The method involves simultaneous solution of no more than 12 algebraic equations, and the small HP 2000 computer has been found sufficient for calculations, irrespective of the application.

325 **Study and measurement of impact damping in PWR reactor coolant system seismic and accident restraints.** Hennart, J.C. (Westinghouse Nuclear Europe, Brussels (Belgium)). pp F4/4 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper describes the program, undertaken jointly by Westinghouse Nuclear International and the Universite Libre de Bruxelles, to determine the impact damping in the reactor coolant system lateral restraints of Westinghouse design.

326 **Elastic-plastic response of PWR coolant pipes containing postulated circumferential flaws.** Palusamy, S.S.; Chirigos, J.N.; Campbell, T.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). PWR Systems Div.). pp F5/2 (1-2) of Structural mechanics in reactor tenology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

327 **Crack growth rate of PWR piping.** Bethmont, M.; Doyen, J.J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Paris La Defense (France)); Lebey, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques). pp F5/10 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Safety analysis in pressurized water reactors must take into account the growth of possible defects in the reactor coolant components, particularly in the reactor coolant piping. The Aquitaine 1 Program, carried out jointly by FRAMATOME and the CEA is intended to improve knowledge about cracking mechanisms in AISI 316 L austenitic stainless steel under conditions similar to those of the PWR environment (irradiation excluded). Experiments of fatigue crack growth are performed on piping elements, scale 1/4 of primary pipings, by means of internal hydraulic cyclic pressure. Interpretation of results requires a knowledge of the stress intensity factor Ksub(I) at the front of the crack. Results of a series of calculations of Ksub(I), obtained by different methods for defects of finite and infinite length (three dimensional calculations) are given in the paper. The following have been used: calculations by finite elements, calculations by weight functions.

328 **Experimental studies of PWR secondary piping in case of steam break.** Martin, A. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)); Cheissoux, J.L.; Garcia, J.L. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France)). pp F6/3 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The experimental programme performed at Cadarache Center on EDITH facility through an agreement between CEA and FRAMATOME is directed to study mechanical behaviour of P.W.R. steam piping and associated structure after a break opening corresponding to ANS standards. Experiments were carried out with splits and double guillotine ruptures, using a pyrotechnical system on the reduced scale (1/10) of a 900 MWe three loops P.W.R. in the following conditions of pressure and temperature: p = 70 bar, T = 286°C. After a short description of facility and experiments, test results are given. First, attention is focused on behaviour of piping, supporting system (pipe-whip restraints) and efforts exerted on civil engineering when splits are created: two cases are discussed depending on stability or instability of the break. Then double guillotine ruptures are examined in the same way. An analysis of stability of longitudinal breaks is presented, using a two criteria approach based on fracture mechanics methods; it enables us to make predictions of critical flaw sizes. Conclusions are drawn concerning safety assumptions made in ANS standards.

329 **Nonlinear, dynamic, plastic component-support analysis.** Elfmann, W.; Heeschen, U.; Mueller, G. (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Hauptbereich Reaktortechnik). pp L8/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In German)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The components in the primary circuit of Kraftwerk Union pressurized water reactors are so located that the pressure vessel is the fixed point for all loops. The support structure of the pressure vessel must be designed to withstand all loads which either arise within the primary system, or which are transmitted through the concrete structure i.e. dynamic loadings from earthquakes etc., so that the vessel fulfil its intended function. In addition, the support structure forms part of the reactor room floor, which leads to additional loading during fuel-element change. The multitude and variety of loadings necessitates, in the design of the RPV-support, different methods of analysis. This report describes how the support-loadings are calculated for each of the specified load cases, and which methods of calculation are used.

330 **Analysis and design of containment liner/anchorage system.** Liu, T.H.; Loceff, F.; Moore, W.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). pp L9/8 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This study presents the stress analysis for pre- and post-buckling behavior in a liner/anchorage system. In the pre-buckling analysis, allowable buckling strains are determined for assumed buckled patterns. Variations in the arrangement of the liner and anchorage pattern and deviation in geometry resulting from fabrication and erection tolerances as suggested by US NRC Standard Review Plan 3.8.1 are also studied. Curves are plotted for such parameters as liner/anchorage geometric pattern, liner thickness, and other deviations to give design information for the system.

331 **Methods to determine the influence of quality assurance on the reliability of primary components of a PWR.** Schmitt, W.; Wellein, R. pp M8/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. M. Methods for structural analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

By introducing a detection probability of the ultrasonic inspection the effect on the initial defect distribution and thus on the reliability can be estimated. This effect on the reliability is very heavily dependent on the shape of the assumed detection probability. Using that of the Marshall Report the failure probability of the component in question decreases by a factor of approximately 100. The influence of the hydro-test on the reliability turns out to be very dependent on the time passed since the test. Generally speaking the effect during the first years after the test is very considerable, whereas it strongly decreases for the time after that. Taking into account the short intervals between the in-service inspections (e.g. four years) the reliability of the components referred to can be shown to be extremely high. Several parameter studies may exhibit the weak points of the analysis.

## 2103 Power Reactors, Non-breeding, Graphite Moderated

*REFER ALSO TO CITATION(S) 169, 170, 171, 248, 432, 555, 592, 593, 601, 602, 682, 684, 689, 721, 722, 723, 724, 725, 731, 732, 737, 820, 832, 839, 841*

332 (IWGHTR—2, pp 1-14) **Characteristics of the prestressed concrete reactor vessel of the HHT demonstration plant.** Schoening, J.; Schwiers, H.G. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

The paper concentrates on the design studies of the HTGR prestressed concrete reactor vessel (PCRV) for the HHT Demonstration Plant. The multi-cavity reactor pressure vessel accommodates all components carrying primary gas, including heat exchangers and gas turbine. For reasons of economics and availability of the reactor plant, generic requirements are made for the PCRV. A short description of the power plant is also presented.

333 (IWGHTR—2, pp 15-33) **Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.1. Design of the multi-cavity prestressed concrete reactor vessel with warm liner.** Lafitte, R.; Marchand, J.D. (Bonnard et Gardel, Ingenieurs-Conseil, Lausanne (Switzerland)). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

The design studies and tests described in this paper were undertaken as part of "PROJECT HHT", a German-Swiss joint effort for the development of high-temperature helium cooled reactors with direct-cycle turbine. The prestressed concrete reactor pressure vessel encloses the core of the reactor itself, the heat exchangers (coolers and recuperators), the helium turbine, the main helium circuit, all nuclear and thermal equipment, and auxiliary reactor cooling equipment. In order to make the liner accessible for inspection, no thermal insulation is provided between the coolant and the liner. The temperature of the helium in contact with the liner is limited to 200°C, under all normal operation conditions of the reactor. In the HHT reactor pressure vessel, the resisting structure is protected thermally by a layer of warm concrete between the liner and the structural prestressed concrete. The main features of this pressure vessel are the marked pressure differences in the cavities during normal operation, and the use of warm liner. The objectives of the reference design were chiefly related to the sizing up of the main structure, taking into account the modifications to be expected in the material characteristics as a result of the high temperatures developed.

334 (IWGHTR—2, pp 33-43) **Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.2. Three-dimensional analysis of the temperature and stress fields in a HHT vessel, including effects of the thermal creep.** Rodriguez, C.; Rebora, B. (Ecole Polytechnique Federale, Lausanne (Switzerland)). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

The thermal rheological calculation of the prestressed concrete reactor vessel for the HHT-670 MW(e) Demonstration Plant is presented in the paper. The main aim of this calculation is to evaluate the effects of the elevated temperature and various loads on the liner as well as on the hot concrete.

335 (IWGHTR—2, pp 44-50) **Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.3. Experimental studies on the behaviour of concrete and liner at high temperature.** Walther, R.; Coendoz, G.; Schelling, G. (Ecole Polytechnique Federale, Lausanne (Switzerland)). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

In connection with the HHT PROJECT (Helium High Temperature Reactor), jointly developed in Germany and Switzerland, an extensive test programme is presently being conducted at the Swiss Federal Institute of Technology in Lausanne in order to gain more experimental information about the rheological and technological problems of Prestressed Concrete Reactor Vessels with warm liner. This programme, executed in close collaboration with Bonnard and Gardel, Consulting Engineers Ltd, consists of, at this stage, three essential parts, namely: 1. Tests on the behaviour of the hot concrete layer; 2. Tests on the behaviour of the anchorages; 3. Tests on the behaviour of the liner. In the following text, some details of this test programme are presented.

336 (IWGHTR—2, pp 51-57) **Multicavity PCPVs for HTR and GCFR systems.** Eadie, D.Mc.D. (Nuclear Power Co. (Risley) Ltd. (UK)). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

There is little extra to report since the presentation of the paper 180/75 Multicavity PCPVs for HTR and GCFR Systems by P.L.T. Morgan and J.N. Bradbury at the International Conference on Experience in the Design, Construction and Operation of Prestressed Concrete Pressure Vessels and Containments for Nuclear Reactors at York, England, in September 1975. The paper presented at the York Conference demonstrated how a particular mode of behaviour could develop in a very local region between the pods and the external wall of a multicavity pressure vessel. Two main points emerge from the paper presented at York - 1. Local analysis for equilibrium of parts of the structure are as important as analysis of the general structural behaviour. With modern computer techniques, in which crack propagation and plasticity may be included, the development of local critical areas can be ooserved, but the idealisation of the structure has to be sufficiently refined and the cost will be high; 2. Criteria for acceptance of a design must be realistic and must be continually reviewed in the light of the trends of design philosophy. In conclusion, some pictures of model tests demonstrate the physical reality of the mode of failure described in the paper.

337 (IWGHTR—2, pp 58-63) **HTR applications of the Austrian PCPV.** Nemet, J. (Reaktor Forschungs- und Baugesellschaft m.b.H., Seibersdorf (Austria)); Fritz, K. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Forschungszentrum). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

The main scope of the development and experimental verification of a new type of Prestressed Concrete Pressure Vessel (PCPV) was a significant gain in operational safety and, as a consequence, availability. An analysis of possible disturbances and downtimes of conventional PCPV's shows two ways to improve the operational safety: a) to make the working conditions of the liner, the most essential component, safer, thus decreasing the probability of a leak; b) to improve the possibilities for inspection, leak detection and repair, thus reducing shut-down times. The Austrian PCPV offers a solution to these requirements. The main characteristics of the new vessel concept, developed and tested in Austria, are: Elastic hot liner, accessible for inspection and repair; adjustable wall temperature, matching the respective operating conditions of HTR's optimally; leak limitation and detection, controlled leak evacuation.

338 (IWGHTR—2, pp 84-94) **Thermal insulation of the high-temperature helium-cooled reactors.** Kharlamov, A.G.; Grebennik, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

Unlike the well-known thermal insulation methods, development of high-temperature helium reactors (HTGR) raises quite new problems. To understand these problems, it is necessary to consider behaviour of thermal insulation inside the helium circuit of HTGR and requirements imposed on it. Substantiation of these requirements is given in the presented paper.

339 (IWGHTR—2, pp 176-183) **EDF's (Electricite de France) in service control for GCR type reactor vessels.** Douillet, M.G. (Electricite de France, 38 - Grenoble). Mar 1979. (In French). Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

This paper presents the performance of the data acquisition and processing systems developed by the French EDF for controlling and testing the mechanical properties (thermal stress, deformations, cracks,...) of prestressed concrete vessels for GCR type reactors.

340 **Automatic data collection in PIE.** Watts, A.J. (UKAEA Atomic Energy Establishment, Winfrith); Molloy, T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 336 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

341 **Post-irradiation examination at Radiometallurgy Division, BARC, Bombay.** Bahl, J.K.; Sivaramakrishnan, K.S.; Roy, P.R. (Bhabha Atomic Research Centre, Bombay (India)). pp 364 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

342 **Role of PIE in the development of the Magnox fuel element in the UK.** Cribb, R.J.P.; Davis, T. (UKAEA Windscale Nuclear Power Development Labs.); Duckworth, F.C.; Hines, G.F. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Edge, T. (British Nuclear Fuels Ltd., Springfields). pp 1-6 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Post-irradiation examination of fuel elements from Magnox power reactors has been carried out in the United Kingdom for 24 years. The way in which this considerable effort has contributed to the development of the fuel element is described. It is shown how the results of PIE have enabled the target irradiation levels at commercial Magnox stations to be raised in stages from 3000 MWd/t CAI to levels approaching the reactivity limit at about 6000 MWd/t CAI.

**343 Contribution of post-irradiation examination to the development of AGR fuel.** Newbigging, A.W.P.; Thorpe, G. (UKAEA Windscale Nuclear Power Development Labs.). pp 19-23 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

This review describes the important role which Post-irradiation Examination of fuel from the prototype WAGR has played in the co-operative effort, with fuel designers and developers, reactor operators and experimenters in securing an AGR fuel design which has been tested satisfactorily to and beyond the conditions of rating and temperature to be met in the Commercial AGRs. The advantages of having a post-irradiation examination facility which is closely integrated with the WAGR yet independent of it and of having a large buffer store in which the fuel is stored dry are stressed.

**344 Objectives and organisation of a national post-irradiation examination programme for commercial advanced gas-cooled reactor fuel.** Hines, G.F.; Waddington, J.S. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Skinner, J. (UKAEA Windscale Nuclear Power Development Labs.). pp 25-30 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The importance of fuel endurance to reactor availability was recognised at the inception of the British Nuclear Power Programme and led to the establishment of a research programme involving the two electrical generating utilities, the fuel manufacturer and the UKAEA. The success of the work on magnox fuel led naturally to a similar programme on CAGR stringers and following final testing in the prototype WAGR, new facilities were commissioned by UKAEA/BNFL at Windscale and the CEGB at Winfrith Heath and Berkeley Nuclear Laboratories. In order to operate such a programme it has been necessary to establish overall objectives and to ensure that these are matched to the available resources. This report reviews the progress of the work in the 3 years following reactor start-up and shows how the programme is operated.

**345 Holographic post irradiation examination of AGR fuel elements.** Tozer, B.A.; Webster, J.M. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.); Haddrell, V.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 35-41 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Optical inspection of discharged fuel elements from Advanced Gas Cooled Reactors, whether undertaken in the Irradiated Fuel disposal system at the station or at a post irradiation examination centre, can normally only be performed remotely. Because of the very high radiation levels near the surface of the fuel element, viewing must be carried out through viewing windows more than 2 m thick, hence the examination is very time consuming and even so, the quality of the results is very limited. Holography, an optical process whereby an image of the original subject can be reconstructed in three dimensions, can be used to allow subsequent detailed optical examination in normal open laboratory conditions. The range of measurements which could be carried out and the limitations in resolution are discussed. The possibility of detecting pin bowing, cladding collapse and carbon deposition is discussed. It is shown that the information stored on a hologram used for PIE could be in excess of $10^{13}$ bits compared with about $4 \times 10^{7}$ attainable by normal photography. A resolution of 10 $\mu$m at the rear of the element and 6 $\mu$m at the front could be obtained using a proposed holocamera compared with 250 $\mu$m in the plane of focus presently being obtained by conventional photography, with a depth of field of 150 mm. A resolution of 20 $\mu$m at the front end of the fuel element has already been obtained under laboratory conditions. The paper illustrates the present state of development of this work.

**346 Review of non-destructive testing techniques employed by the CEGB for the post-irradiation examination of Magnox and CAGR fuel.** Hines, G.F.; Haddrell, V.J.; Molloy, T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 81-85 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The paper reviews some of the non destructive testing (NDT) techniques used for the examination of fuel elements taken from the Magnox and Advanced Gas Cooled reactors of the Central Electricity Board (CEGB). With these methods it is possible to obtain large amounts of qualitative information quickly or quantitative data on a longer timescale. Because a minimum of fuel element breakdown is required these methods help to improve the examination rate and reduce cave contamination. The further development of these techniques and their possible use in the fuel handling routes at power stations is briefly discussed.

**347 Computer data processing systems used in the assessment of Magnox and AGR fuel performance.** Uglow, A.G. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 115-120 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Computer techniques have been developed for the collection, storage and retrieval of manufacturing, operational and post-irradiation examination data used in the assessment of Magnox and AGR fuel performance. Extensive use is made of specialised systems developed by the CEGB: Information System (INFSYS) for retrieval of data stored in large files and AGR Data Operating System (ADOS) to provide operating histories for AGR fuel. With the aid of remote terminal facilities at the power stations and research laboratories providing direct access to an IBM 370 computer situated in London, data can be processed to give graphical and tabular displays for manual assessment, and in a form required for use in statistical analysis routines and fuel performance computer codes.

**348 New and improved post-irradiation techniques for examination of fission products and actinides in coated particles.** Stoever, D.; Biedermann, P.; Hecker, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp 143-148 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Different post-irradiation techniques were presented being qualified for the determination of fission product and actinide concentrations in coated particle fuel. The measurement of cesium distributions in variably designed particle types was discussed with regard to chemical etching, mechanical grinding and especially laser boring. The technique of laser boring allows quantitative sampling in all material zones of an irradiated particle and in addition to fission products actinide concentrations could be determined. Cracked coatings of irradiated particles were simulated by post-irradiation radial laser boring and release characteristics were measurable. The $\alpha$- and $\gamma$-counting systems as well as the annealing technique were described. The results show the usefulness and the range of application of these techniques.

**349 Irradiation performance assessment of coated particle fuels using the IMGA system.** Kania, M.J.; Tiegs, T.N.; Valentine, K.H. (Oak Ridge National Lab., TN (USA)). pp 327 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

350 **Detection and location of leaks in irradiated CAGR fuel.** O'Keefe, J.M.; Russell, A.I. (UKAEA Windscale Nuclear Power Development Labs.); Cornell, R.M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 328 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

351 **Gamma scanning of full scale HTR fuel elements.** Simpson, J.A.; Harrison, T.A. (UKAEA Atomic Energy Establishment, Winfrith); Nabielek, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). pp 331 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

352 **Determination of end-of-life failure fraction of HTGR-fuel particles by post-irradiation annealing and beta-autoradiography.** Thiele, B.A.; Schunck, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)); Mehner, A.-W. (Hochtemperatur-Reaktor-Brennelement G.m.b.H. (HOBEG), Hanau (Germany, F.R.)). pp 333 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

353 **Post-irradiation examination techniques for CAGR fuel.** Cornell, R.M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 335 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

354 **Instrument to measure the wear scars formed on the tie bar of the CAGR fuel assembly.** Hitchcock, P.A.; Paisey, M.J.; Price, D.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 338 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

355 **Investigation of the activity release from HTR fuel element spheres during storage.** Duwe, R.; Groos, E.; Stradal, K.A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). pp 347 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

356 **Apparatus for fission gas release measurements from HTGR fuel elements at very high temperatures.** Groos, E.; Schenk, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). pp 348 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

357 **Carbon formation processes relevant to advanced carbon dioxide-cooled reactors.** Campion, P. (UKAEA Springfields Nuclear Power Development Labs.). pp 53-66 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The Advanced Gas-Cooled Reactor (AGR) is graphite moderated and cooled by carbon dioxide at a pressure of 4.14 MPa. There is no significant thermal reaction between carbon dioxide and graphite at temperatures < 920 K but radiolysis of carbon dioxide leads to the formation of $CO_2^+$ ions capable of reacting with the graphite to form carbon monoxide with resultant mass transport from the moderator. The carbon monoxide reaction product confers a degree of inhibition on the radiolytic oxidation by intercepting the $CO_2^+$ ions in the gas phase but in order to be sure that moderator weight losses will not be life-limiting for a power station with a 30 year design life, methane is added to inhibit the reaction to the required oxidation rate. The optimisation of an AGR coolant composition had to take into account thermal, as well as radiolytic, stability since the addition of an organic inhibitor raised the question of whether there would be any deleterious deposition on heat transfer surfaces. The most sensitive heat transfer surface is that of the fuel element. Carbonaceous deposition on the fuel element surface could lead to enhanced clad temperatures and, in turn, failure of a fuel stringer necessitating uneconomic premature withdrawal from the reactor. This paper reviews a series of irradiation experiments mounted to study potential carbon deposition reactions in the methane/carbon monoxide/hydrogen/moisture/carbon dioxide system.

358 **Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops.** Bennett, M.J.; Houlton, M.R. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.); Faircloth, R.L.; Norwood, K.S.; Prior, H.A. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.); Firth, R.J. (UKAEA Windscale Nuclear Power Development Labs.). pp 81-89 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Gas loops, incorporating irradiation assemblies in the 6V3 hole of the Harwell Materials Test Reactor, DIDO, have been used as an accelerated test facility for the investigation of radiation induced carbonaceous deposition on 20% Cr/25% Ni/niobium stabilised stainless steel from carbon dioxide based gas compositions, containing carbon monoxide, methane and water vapour. This paper will survey the experimental observations on the principal parameters underlying deposition and present a generalised mechanism of the processes involved.

359 **Carbon deposition on 20/25/Nb steel using an electrically heated AGR fuel pin.** Blanchard, A.; Campion, P. (UKAEA Springfields Nuclear Power Development Labs.). pp 90-97 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The radiolysis of carbon dioxide in gas-cooled reactors leads to the production of active species capable of reacting with the graphite moderator to form carbon monoxide with a resultant gradual loss of moderator. In the early days of gas-cooled reactor design, the intention was to allow the carbon monoxide concentration to increase and use this reaction product to inhibit the initial radiolysis of the carbon dioxide. Exploratory irradiation experiments using 4 to 7% carbon monoxide revealed that low density deposits ranging in colour from light grey through brown to black were found in the temperature range 470 to 600 K. In view of the

fact that this type of deposition could adversely affect heat transfer processes in both fuel channels and heat exchangers, together with the fact that carbon monoxide was not sufficiently powerful as a graphite oxidation inhibitor, methane was selected as the primary inhibitor for the AGR series of power stations. This paper describes some carbon deposition experiments using an electrically heated 'dummy fuel element' linked to a recirculating carbon dioxide irradiation loop in which carbon monoxide concentration, methane concentration, fuel pin temperature and the chemical nature of the fuel pin surface were varied.

360 **Role of adsorption processes in gas graphite reactions in high temperature gas-cooled reactors.** Nieder, R. (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Juelich (Germany, F.R.)). pp 111-119 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The chemical reactions which occur in the primary circuit of a high temperature reactor are characterized by the following parameters: the fuel cladding and the reactor internals consist of graphite; the graphite temperatures range between approx. 300°C and 1100°C; the coolant used is very pure helium containing only very low impurities of $H_2O$, $CO_2$, CO, $CH_4$, $H_2$, $N_2$, Ar, Xe and Kr isotopes; thermal and radiolytic chemical reactions take place. Operational experience has shown that gases chemisorbed on the graphite lattice greatly affect the reactions under normal operating conditions. The purpose of this paper is to examine in detail the role played by the adsorbed gases. Not only the reactions of the helium impurities with graphite, so-called corrosions, are to be discussed, but also the manner in which the impurities react with each other.

361 **Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water.** Faircloth, R.L.; Prior, H.A. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). pp 120-128 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The Advanced Gas Cooled Reactor (AGR) was introduced for the second generation of British nuclear power stations. It was recognised that problems of compatibility between the carbon dioxide coolant and the moderator graphite would arise because of the increased power rating of the reactor compared with the first generation MAGNOX system. This led to the realisation that it would be necessary to reduce the rate of oxidation of the moderator to acceptable levels by the addition of inhibitors to the coolant and to this end carbon monoxide and methane were chosen. This paper describes experiments which have been made in a materials testing reactor at AERE Harwell in which moderator graphite reaction rates have been measured in carbon dioxide containing carbon monoxide at concentrations between 0.03% and 2% and methane concentrations up to 600 vpm. The effect of impressing a flow of coolant through the graphite structure, the so-called ventilation effect, and the role of coolant temperature and pressure have also been assessed. The results confirm the inhibiting power of methane and carbon monoxide on the graphite/$CO_2$ reaction and demonstrate that the application of ventilation in the presence of these inhibitors enhances their effect. A minimum or 'terminal' oxidation rate may be achieved by the CAGR Gilso carbon graphites when irradiated in the presence of 200 vpm methane, or more, under appropriate conditions.

362 **Graphite oxidation experiment to high weight loss under CAGR conditions.** Blanchard, A.; Ketchen, J.; Scholfield, P.; Campion, P. (UKAEA Springfields Nuclear Power Development Labs.). pp 129-133 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The reaction of moderator graphite with radiolysed carbon dioxide coolant has been the subject of intensive study during the development of the UK Magnox and Civil Advanced Gas Cooled Reactor programme. Irradiation of carbon dioxide gives rise to short lived, energetic, species and graphite undergoes significant oxidation, even at moderator temperatures of around 670 K. Reaction is essentially confined to the internal porosity and, since this increases with oxidation, exponential weight loss of the structural material can occur. To retain adequate moderator strength over the station life, inhibitors are added to the coolant. The accepted mechanism of inhibition by the major carbon monoxide and methane additives is a competition with the graphite pore wall for the oxidising species. Further inhibition may result from the formation of a sacrificial surface layer, particularly derived from the oxidation of methane. It follows that, in the presence of inhibitors, oxidation should be confined to the smaller pores; where the probability is highest that the majority of oxidising species will reach the pore wall. In order to test this heterogeneous weight loss model, an ambitious experiment was mounted using the Anglo-French BFB loop in the Siloe reactor at CEN Grenoble in France. This experiment has now been completed and the results of some of the measurements which have been made are reported in this paper.

363 **Modelling of AGR radiolytic graphite corrosion.** Best, J.V. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 141-147 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The radiation-induced reaction between graphite and $CO_2$ is the main cause of moderator corrosion in the Advanced Gas-Cooled Reactor. Extensive research has been carried out in the past on the inhibition of the reaction by carbon monoxide and methane. In this paper a model for the overall corrosion process is developed from the fundamental radiation chemistry concepts of the system. In the first part of the paper, a single equation relating corrosion rate to gas composition is derived from the mechanistic model and the paper goes on to show how the basic pore structure modelling can be used to predict cumulative weight loss in moderator graphite.

364 **Implications of radiolytic graphite corrosion on AGR brick integrity.** Metcalfe, M.P. (Central Electricity Generating Board, Gravesend (UK). Scientific Services Dept.). pp 155-163 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The long term structural integrity of the major components of the Advanced Gas Cooled Reactor (AGR) is extremely important if economic and safe operation is to be ensured. In this context the integrity of the graphite core is vital in that it performs two prime functions, that of neutron moderation and of providing structural location of the fuel and control rods. Both of these functions must be maintained under all normal and fault conditions likely to be experienced throughout reactor life. The objective of this paper is to show how information from the study of the graphite/ $CO_2$ reaction can be used in the complex assessment of brick integrity. A simplified review is given of the steps taken in such an assessment, including the types of loads experienced by bricks within the core and the graphite property changes associated with radiolytic corrosion. Finally, a number of modelling techniques are considered for simulating these property changes so that the resulting brick strength can be assessed.

365 **Oxidation of carbonaceous deposit in nuclear reactors.** Skinner, R.F.; Williams, W.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 189-195 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The various considerations underlying the CEGB's interest in the optimisation of reactor coolants have been discussed. Together with graphite corrosion and carbon deposition, deposit oxidation is also affected by coolant composition and must be considered in the optimisation. This paper describes recent data obtained in the BNL Gamma Irradiation Facility on the effect of CO, $CH_4$ and $H_2O$ on the oxidation of deposit derived from $CH_4$ and compares it with data obtained elsewhere. An attempt is also made to correlate the BNL data with generally accepted theories of the C-$CO_2$ reaction.

366 **Behaviour of hydrogenous compounds in reactor coolants.** Wickham, A.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 220-226 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Hydrogenous compounds are present in the coolant gas of all CEGB nuclear reactors. They are useful inhibitors of radiation-induced corrosion of the moderator. Hydrogen and methane deactivate the oxidising species in the gas phase, although their contribution to this process at their normal concentrations is largely insignificant in the presence of approximately 1% carbon monoxide which arises as the corrosion product. It is from the formation of protective deposits from methane and from the combination of water and carbon monoxide that the principal benefits are derived. Thus the methane concentration in the coolant of the highly rated CAGRs is presently maintained at 165 vpm with water controlled at 300 vpm (a higher concentration is undesirable because of the possibility of condensation of corrosive solutions in cool parts of the circuit). There are further constraints on the permissible concentrations of hydrogenous compounds. Too much methane can lead to the deposition of carbonaceous material on the heat-transfer surfaces of the fuel elements, whilst excessive hydrogen or water can exacerbate steel corrosion. There is also a lower limit on hydrogen concentration of approximately 25 vpm because it inhibits radiolytic polymerisation of carbon monoxide which can otherwise give deposits on the cooler fuel elements in Magnox reactors. Details of these various processes have been published; this paper is concerned only with the interactions between hydrogenous compounds.

367 **Trace organics in AGR coolants.** Smith, R. (Loughborough Univ. of Technology (UK)); Green, L.O.; Johnson, P.A.V. (UKAEA Springfields Nuclear Power Development Labs.). pp 248-255 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Several analytical techniques have been employed in previous studies of the stable organic compounds arising from the radiolysis of methane/carbon monoxide/carbon dioxide coolants. The majority of this early information was collected from the Windscale AGR prototype. Analyses were also carried out on the liquors obtained from the WAGR humidryers. Three classes of compound were found in the liquors; aliphatic acids in the aqueous phase and methyl ketones and aromatic hydrocarbons in the oily phase. Acetic acid was found to be the predominant carboxylic acid. This paper outlines the major findings from a recent analytical survey of coolants taken over a wide range of dose rate, pressure, temperature and composition, from materials testing reactor facilities, WAGR and CAGR.

368 **Sulphur ingress into Hinkley Point 'B' AGR and its effect on carbon monoxide oxidation.** Pritchard, J.A.; Matthews, P.C. (Central Electricity Generating Board, Bristol (UK)). pp 271-279 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Measurements of sulphur (present as carbonyl sulphide COS) in the Hinkley Point 'B' AGR coolant gas circuits following commissioning, indicated concentrations up to 400 vpb. This was substantially higher than that found in WAGR and Magnox coolants and, in view of the known susceptibility of nickel and chromium to attack by sulphur, the possibility of enhanced corrosion of the high nickel and chromium steels within the reactor circuit was suggested. Based largely on WAGR experience, a maximum tolerable COS concentration of 35 vpb was recommended by corrosion specialists. This paper deals with the work carried out to determine, and remove, the major source of sulphur and the methods adopted to reach the recommended maximum level. In addition the interaction of sulphur and sulphur control with the operation of the catalytic carbon monoxide converter (recombination unit) is discussed.

369 **Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors.** Turner, F. (UKAEA Risley Nuclear Power Development Labs.). pp 361-368 of Fourth international conference on pressure vessel technology. Volume 2. Design, analysis, components, fabrication and inspection. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

Tensile, Charpy and bend specimens of plate, forging and weld metal are exposed in the lower and upper zones of the reactors to neutron fluxes covering the range experienced by the vessels. The test conditions are described, the results presented and discussed.

370 **Surveillance of prestressed concrete pressure vessels under commissioning and operational conditions at Hunterston 'B' Power Station.** Aird, H.M. (South of Scotland Electricity Board, Glasgow (UK)); Forgie, S.H. (Williams (J.) and Partners, Glasgow (UK)); Holland, J.A. (Rendel, Palmer and Tritton, Glasgow (UK)). pp H3/4 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Monitoring procedures were established to satisfy the Statutory requirements set by the Licensing Authority (The Nuclear Installations Inspectorate), and to demonstrate the continuing safety of the Prestressed Concrete Pressure Vessels (P.C.P.V.) under operational conditions to the Purchaser and Operator (South of Scotland Electricity Board), and the N.I.I. For the long term, 80 vibrating wire strain gauges have been selected as indicating the general behaviour of each vessel under commissioning and operational conditions. A programme of tendon check loading has been set up, allowing an estimate of the prestress obtaining in the vessel to be made. Also, strands are withdrawn for visual and metallurgical examination. Regular temperature scans are carried out using the thermocouples installed in the vessel concrete and on the liner and penetrations. The results of these and other monitoring procedures are discussed. It is concluded that the Prestressed Concrete Pressure Vessels at Hunterston 'B' Power Station are performing in a predictable and satisfactory manner.

371 **Aspects on the design of modern PCRV with respect to the HHT-vessel.** Schnellenbach, G.; Schimmelpfennig, K. (Zerna - Schnellenbach, Ingenieursozietaet fuer Konstruktiven Ingenieurbau, Bochum (Germany, F.R.)). pp H3/8 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In German)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In the present time, activities in designing PCRV in the Federal Republic of Germany are concentrated on development of the vessel for a high temperature reactor with helium turbine in direct circuit, spherical fuel elements and an electrical output of 600 MWe, called HHT-Demo-Anlage. There are a number of new requirements for such a vessel given by the characteristics of the plant and by the decision to integrate the whole gas circuit in a prestressed concrete vessel. The paper gives a short survey on the special conditions for such a PCRV, on methods for preliminary design and the problems to be solved hereby, on trends concerning advanced design criteria and on research and development work still necessary.

372 **Parametric study on ligament stresses in multicavity prestressed concrete reactor vessels (PCRV's).** Speidel, S.R. (Bilfinger und Berger Bau-A.G., Mannheim (Germany, F.R.)). pp H4/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The work presented in this paper has been performed with regard to the PCRV for High Temperature Reactors (HTR). This reactor type is presently developed in the F.R.G. for electric power and process heat generating plants. In the design of the PCRV the ligament stresses are an important layout criterion. An assessment of such stresses is useful to the correct dimensioning of the ligament widths without excessive analytical efforts. A horizontal section at midheight level of the PCRV is modelled for numerical analyses. It is assumed that the behaviour of a $30^0$-sector under prestressing and internal pressure loads is representative for the characteristics of the entire plane section. For stress analysis purposes, the geometrical dimensions, as the diameter and location of pods, diameters of core and PCRV, are varied within reasonable limits. The evaluation is made for significant ligament points, but for ligament zones as well, by indicating principle stresses. The diagrams so received will permit a simple appraisal of ligament stresses to be expected within the cylindrical section originating from the load cases of internal pressure and prestressing, if the geometrical relations of a vessel are known as input data. All calculations have been done assuming linear elastic material, neglecting creep, shrink and thermal effects. Initial prestress is governing the compressive ligament stresses. This parametric study facilities an appraisal of ligament stresses under late life conditions, too (assuming late life prestress values).

373 **Feasibility of a multicavity PCPV with elastic hot liner for HTR.** Schwiers, H.G. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)); Hinterleitner, H.; Walluschek, W. (Reaktor Forschungs- und Baugesellschaft m.b.H. und Co., Seibersdorf (Austria)). pp H6/3 (1) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

374 **Characteristics of the PCRV of the HHT demonstration plant.** Schoening, J.; Schwiers, H.G. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). pp H6/4 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The prestressed concrete pressure vessels (PCPV) for Nuclear Power Plants planned or constructed up to now were either of a single-cavity type (THTR 300) or symmetrical multi-cavity design vessels (HTR 1160, Hartlepool). The former contains the core and the heat exchanger in a single cavity whereas in the latter the components are arranged seperately in vertical cavities. The vertical cavities in the HHT-Plant-PCRV cannot be arranged in a rotational-symmetric configuration. The cavities which are of different lengths have variously, diameters of 2, 3 up to 5,8 m and each is subject to different pressure loadings. The cavity arrangement is mainly dictated by the requirements for the gas-ducting and to a much lesser extent by the civil engineering aspects. In addition to the vertical cavities, the bottom cap contains horizontal cavities for the turboset (5,8 m dia.) and the generator (ca. 9 m dia.). The turboset cavity is designed for pressure; the cavity for the generator is not subject to pressure.

375 **Design, construction and pressure test of a PCIV gas storage vessel for the THTR-300.** Lethert, E.K.; Wester, H.J. (Siempelkamp Giesserei K.G., Krefeld (Germany, F.R.). Abt. Reaktortechnik); Schwiers, H.G. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). pp H7/3 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The PCIV for gas storage will be located in the auxiliary building of the Schmehausen nuclear station. It is used in the redundant emergency shut down system. For the cast iron a lamellar grey cast iron is used. The liner consists of ductile steel. High strength cold rolled steel wire was selected for the axial and circumferential prestressing systems. The design requirement called for a net internal volume of 17.5 $m^3$ and a pressure of 230 bar. The design had to consider static loads only and assumed a factor of safety against block separation of at least 1.5. Using the above criteria the major vessel dimensions were obtained. The cast iron portion of the vessel consists of three cylindrical rings and two end sections. The outside surface is described by a polygon with 28 corners. The required hoop prestressing steel is evenly arranged in eleven circumferential tendons. The hoop prestress is applied indirectly through 28 stressing shoes under each tendon. The machining of the outside surfaces was done on a vertical turret lathe and a portal milling machine. The axial ducts were obtained by deep-hole-boring.

376 **Impact testing of steel fibre reinforced concrete slabs with liner.** Stangenberg, F. (Zerna - Schnellenbach, Ingenieursozietaet fuer Konstruktiven Ingenieurbau, Bochum (Germany, F.R.)); Buttmann, P. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)). pp J7/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In the reactor building of THTR nuclear power plant Schmehausen, reinforced concrete slabs with liner will be built in. Their two main functions are: leak tightness and protection against internal impacts. Several types of slabs were considered for comparison: Concrete with reinforcing steel bars and steel liners of different thicknesses, a liner on one side as well as on both sides, steel fibre reinforcement instead of steel bars.

**377 Design of heat exchangers for high-temperature reactors.** Rautenberg, J.; Spilker, H. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). pp F9/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In German)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The design of heat exchangers for HTR-type reactors is determined among others by the following boundary conditions: long serviceable life, strongly decreasing strength of material in the high-temperature zone, fluid behaviour under normal operating conditions and during accidents. In the latter cases special attention has to be paid to the transient processes. For a definition of permissible material loads, primary and secondary stresses have to be taken into account, considering both creep and fatigue behaviour. This leads to contradictory design requirements and thus inevitably calls for optimization. Since the essential loads producing primary stresses are generally design-based, given parameters, efforts have to be focussed on an analysis of the parameters determining the secondary stresses. The paper presented here gives a detailed account of the complex processes involved and illustrates their effect on design and construction work by several examples.

**378 Two-dimensional vibration test and its simulation analysis for a horizontal slice model of HTGR core.** Muto, K.; Motohashi, S. (Muto Inst. of Structural Mechanics, Inc., Tokyo (Japan)); Kuroda, K. (Electric Power Development Co. Ltd., Tokyo (Japan)). pp 12/2 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The forced vibration test and its simulation analysis of the two-dimensional horizontal slice model of the General Atomic Company's High Temperature Gas-Cooled Reactor (HTGR) core were studied subsequent to the vertical slice model test (K7/8 in 4th SMiRT). The purpose is to clarify such dynamic properties as resonant characteristics and vibration modes of the core, lumping phenomena of blocks, and distribution of reflector reactions.

**379 Life prediction of simple structures subject to cyclic primary and secondary loading resulting in creep and plasticity.** Otter, N.R.; Jones, R.T. (GEC Power Engineering Ltd., Whetstone (UK). Mechanical Engineering Lab.). pp L11/5 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

High temperature reactors are subject to cyclic mechanical and thermal loadings resulting from start up and shut down operations. The design must therefore guard against structural failure resulting from excessive deformation and creep-fatigue damage. Before any simplified inelastic analysis techniques can be applied, their validity needs to be examined under situations representative of the reactor. For this to be carried out it is necessary to determine the behaviour of components, initially geometrically simple, subject to loadings, cyclic primary and secondary in nature, which result in creep and plasticity. Beam-like structures have been investigated on a finite element basis with the aim of determining how cyclic plasticity, creep enhancement and plastic ratchetting vary in relationship with modified shakedown criteria, magnitude of loading and hold time.

**380 High temperature alloys for the primary circuit of a prototype nuclear process heat plant.** Ennis, P.J.; Schuster, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). pp L13/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

As part of a comprehensive materials test programme for the High Temperature Reactor Project 'Prototype Plant for Nuclear Process Heat' (PNP), high temperature alloys are being investigated for primary circuit components operating at temperatures above 750°C. On the basis of important material parameters, in particular corrosion behaviour and mechanical properties in primary coolant helium, the potential of candidate alloys is discussed. By comparing specific PNP materials data with the requirements of PNP and those of conventional plant, the implications for the materials programme and component design are given.

## 2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

*REFER ALSO TO CITATION(S) 284, 479, 485, 532, 537, 551, 594, 595, 596, 597, 603, 604*

**381 Characterisation of sintered $UO_2$ pellets relevant to fuel design and performance.** Das, M.; Bhardwaj, S.A.; Arora, O.P.; Rustagi, R.S. (Department of Atomic Energy, Bombay (India). Power Projects Engineering Div.). pp 335-342 of Proceedings of the symposium on sintering and sintered products [held at] Bombay, October 29-31, 1979. Bombay, India; Department of Atomic Energy (1980).

From Symposium on sintering and sintered products; Bombay, India (29 Oct 1979).

High density sintered $UO_2$ pellets are used in the fuel for Indian Pressurised Heavy Water Reactors (PHWR). To-date more than 8000 fuel bundles have been irradiated in RAPS-1 with a success rate of 99.89%. Currently, from fabrication considerations, efforts are directed towards characterisation and quality control of $UO_2$ powder and pellets. While the specification requirements on (a) moisture and halogen control and (b) density and redensification phenomenon could be met by improved manufacturing processes, certain specific problems were encountered in the areas of pellet microstructure and visual quality standards. Systematic studies were undertaken which have enabled a correlation of fuel performance with grain size in the range (5 - 300 microns) at the power ratings and fuel burnups as obtaining in PHWR. It has been observed that higher grain size has certain beneficial effect on fuel performance as also speculated by other workers. $UO_2$ pellets exhibiting the phenomenon of tear-outs, hairline cracks, micro-cracks, end-capping and surface pits were investigated and revised quality control standards have been evolved.

**382 Design and construction progress on Gentilly 2, Cordoba, Point Lepreau, and Wolsung projects.** Craik, N.G. (Canatom Ltd., Montreal, Quebec (Canada)). pp 43-67 of 20. annual international conference. Toronto; CNA (1980).

Gentilly 2, Point Lepreau, Cordoba and Wolsung are the first 600 MW CANDU nuclear generating stations to be built. Progress in their construction and in the remaining design work for these stations is discussed.

**383 Personal tritium monitor.** Osborne, R.V.; Coveart, A.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). pp 751-754 of Radiation protection. A systematic approach to safety. Oxford; Pergamon Press (1980).

The prototype of a personal tritium monitor is described for measuring tritiated water vapour near workers in CANDU nuclear power plants. The instrument is easily handled and weighs only 2 kg. It contains two ionization chambers which are oppositely polarised to partially cancel the background current due to ambient $\gamma$ radiation. The sample air is drawn in through a moulded plastic

filter assembly by a small pump. The electronics are mounted on a printed circuit board which together with the ionisation chamber, is easily removed for maintenance or repair. The power is supplied by rechargeable Ni-Cd batteries; the lifetime of a charge is about 5 hours. A brief outline of the electronics is given. The sensitivity of the monitor amplifier is 3.2 mV per 0.37 MBq/m³.

384 **BACO fuel rod analysis computer program.** Harriague, S.; Coroli, G.; Savino, E.J. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Departamento Combustibles Nucleares). pp D1/2 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. D. Structural analysis of reactor fuel elements and assemblies. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Tent version is mainly applied to predict the performance of a self standing fuel rod section in pressurized heavy water reactors; however it can be easily extended to every fuel rod type. The code includes models for the elastic, thermal, linear and non linear creep deformation as well as for the redensification, swelling and cracking of the oxide fuel pellet and for the anisotropic thermal, elastic and plastic deformation of the cladding. The temperature distribution and fission gas release pressure are also calculated at the different steps in the irradiation for the changing rod geometry. A central finite difference method and the hypothesis of axial symmetry and modified plane strain allows to write the stress-strain increments at a time step as a finite system of non linear equations. The non linear system of equations is solved by linearisation and inversion of the resulting matrix at each time step. This approach provides an accurate and relatively fast solution if a sparse matrix inversion method is used. The stresses and the strain increments due to crack opening are used as the system unknowns. The boundary conditions and plastic laws are more easily written in terms of stresses rather than strains. Also the pellet-cladding contact pressure agrees with the calculated compressive radial stress at the interface. If this stress becomes tensile the contact is assumed to be broken. Some results representative of the code predictions are reported. These show the potentiality of the code to describe the stress and strain at different points of the rod and times of irradiation. The importance of using a pellet fracture model and an anisotropic description of the mechanical behaviour of a zircaloy cladding are discussed. The iso hoop stress loci at the cladding internal surface are plotted as a function of linear power and burn up.

385 **Fuel bundle end plate analysis by code SPACE.** Chhatre, A.G.; Das, M.; Bhardwaj, S.A.; Rustagi, R.S. (Department of Atomic Energy, Bombay (India). Power Projects Engineering Div.). pp D4/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. D. Structural analysis of reactor fuel elements and assemblies. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The fuel bundles for the Rajasthan Atomic Power Station (RAPS) consist of a closepacked array of 19 elements of about 500 mm length structurally joined by two end plates.

386 **Behaviour of concrete containment under over-pressure conditions.** Atchison, R.J.; Asmis, G.J.K.; Campbell, F.R. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). pp J3/2 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The Atomic Energy Control Board of Canada initiated June, 1975, a major study of the behaviour of concrete containment under over-pressure conditions. Although extensive theoretical and experimental work has been carried out for thick-walled Prestressed Concrete Reactor Vessels (PCRV's), there is a want of information on the non-linear response of thin-walled structures typical of the CANDU, 600 MW(e) cylindrical/spherical, post-tensioned containment shells. The purpose of this paper is to provide an overview of the total program, to present the reasons behind the research contract, and the specification and implementation of the work. The results of the theoretical and experimental work and their implications with respect to Canadian Concrete Containment practice are discussed. This study is unique, and, as far as is known, has no world-wide precedence.

387 **Modelling and predicting behavior of prestressed concrete secondary containment structures using BOSOR 5.** Murray, D.W.; Chitnuyanondh, L.; Wong, C. (Alberta Univ., Edmonton (Canada). Dept. of Civil Engineering). pp J3/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper discusses the techniques used to model a prestressed concrete secondary containment structure using an elastic-plastic simulation of concrete response in tension and a thin-shell computer code (BOSOR5). The code permits the simulation of layers of concrete and of reinforcing and prestressing steel through the shell thickness. Sample results from complete inelastic analyses are presented using two different modelling techniques. It is demonstrated that cracking of concrete accentuates stress concentration effects in the prestressing strand which leads to unrealistic concentrations in areas of bar cut-offs and eccentric junctions. These undesirable concentrations can be eliminated by constructing a model with a continuous reference surface, transition zones and tapered bar cut-offs. The results of the analysis of the improved model are compared to measurements obtained from a test on a 1:14 scale test structure. It is concluded that the modelling technique is adequate to simulate the response of a structure in sufficient detail to identify the limit states, from first cracking to ultimate failure, as the structure deteriorates.

388 **Test of a model of a thin-walled prestressed concrete secondary containment structure.** Rizkalla, S.; Simmonds, S.H.; MacGregor, J.G. (Alberta Univ., Edmonton (Canada). Dept. of Civil Engineering). pp J4/2 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The construction and testing to failure by internal overpressure of a 1:14 scale prestessed concrete secondary containment structure is described. The test structure consisted of a rigid base, cylindrical wall, ring beam and dome. The overall height of the test structure above the base was 12'-6" (3810 mm) and the outer diameter was 10'-6" (3200 mm). Internal pressure was obtained using water and leakage was prevented by using a flexible plastic liner. Measurements made during the test include internal pressure, steel and concrete strains using electric resistance gages, concrete strains using manual gages, concrete crack widths and spacing, and curvatures at base of cylindrical wall. All electronic readings were taken using a 280 channel Nova 210/E digital computer and data acquisition system. Manual readings were typed into data files immediately following each test run so that all data could be reduced and plotted using computer routines. The test structure began to exhibit cracking at an internal pressure of 40 psi (0.28 MPa) and yielding of the reinforcement at approximately 110 psi (0.76 MPa). The structure displayed considerable ductility before failing at an internal pressure of 159 psi (1.10 MPa) by rupture of three horizontal tendons at midheight of the wall.

**389 Analysis of pressure tube elongation and end shield interactions in the CANDU reactors.** Causey, A.R.; MacEwen, S.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Jamieson, H.C.; Mitchell, A.B. (Ontario Hydro, Toronto (Canada)). pp F1/2 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Zirconium alloys change shape as a result of fast neutron irradiation-induced creep and growth. Growth is a change of shape which occurs in the absence of an applied stress. The zirconium alloy components of interest in CANDU reactors are the horizontal pressure tubes, which contain the fuel bundles in pressurized heavy water coolant, and the calandria tubes, which separate the hot pressure tubes from the cold heavy water moderator in the reactor vessel. Depending on the particular reactor design the calandria tubes may, or may not, be rigidly attached to the reactor end shields. Movement of the stainless steel end fittings attached to each end of the pressure tube, which results from thermal and pressure expansion and from irradiation-induced elongation, can be limited by a yoke assembly. Interpretation of the measured elongations of pressure tubes in operating CANDU reactors has required the development of a model to account for the interactions of the elongating pressure tubes with the reactor end shields and calandria tubes. Elongations of the Zircaloy-2 pressure tubes in units 1 and 2 of the Pickering Generating Station, measured periodically during 8 years of operation, are analyzed to determine the unconstrained tube elongation rates (i.e., the rates which would have been obtained in the absence of any interactions). These rates have been combined with measured metallurgical parameters, in an analysis proposed by Holt and Ibrahim, to obtain the creep and growth material constants of the pressure tubes. The forces, which are induced in the pressure tubes when their elongation is restricted by the end shields, are also calculated.

**390 Simulation of the dynamic loads and stresses due to explosive rupture of a pressure tube in a scaled down model of the CIRENE reactor structure.** Chevallard, G.; Famiglietti, M.; Parmeggiani, A.; Possa, G. (Centro Informazioni Studi Esperienze, Milan (Italy)). pp F7/7 (1-12) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The paper presents the results of the tests performed on a 1:5 scaled-down model of the CIRENE reactor structure, called MARC, aimed at determining the dynamic loads and stresses in the main structural components surrounding the heavy water tank due to the explosive rupture of a pressure tube (a practically impossible event, nevertheless carefully examined in the frame of the safety studies).

**391 Tests on a 1,75 m O.D. bolted flange assembly with spiral-wound gaskets.** Bazergui, A. (Ecole Polytechnique, Montreal, Quebec (Canada). Dept. de Genie Mecanique). pp F8/3 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Paper reports on a test program involving leakage behaviour of a double gasketed 1.75 m (O.D.) bolted flange assembly subjected to hydrostatic pressure at room temperature. Fabrication of a heat exchanger for a CANDU-NPP was temporarily stopped so that the channel-cover-tubesheet assembly could be used for the tests. Special instrumentation was developed to measure bolt stress, inner and outer flange displacements, flange to tubesheet metal contact stress and intergasket leakage. The results of two of several flange-face configurations tested are reported. Main conclusions follow: - Very high gasket seating stresses are necessary for adequate sealing. - Flange movement alters contact pressure on inner and outer gaskets. Simple flange face modifications adequatly compensates for this and provides leak-tight joint.

**392 Nonlinear transient dynamic response of pressure relief valves for a negative containment system.** Aziz, T.S. (Acres, Inc., Toronto, Ontario (Canada). Structural Mechanics Dept.); Duff, C.G. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Research Community); Tang, J.H.K. (Ontario Hydro, Toronto (Canada). Design and Development Div.). pp K11/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The response of the piston for the postulated simultaneous effect of pressure and an earthquake is obtained for different parameters and accident conditions. Response quantities such as accelerations, displacements, rotations, diaphragm forces as well as opening time during a design basis earthquake are obtained. The results of the different analyses, as related to the functional operability of the valves, are evaluated and discussed.

**393 Mechanistic assessment of structural failure for missile impacts on concrete structures.** Godbout, P.; Brais, A. (Montreal Univ., Quebec (Canada). Nuclear Engineering Inst.). pp M3/10 (1-13) of Structural mechanics in reactor technology. Trnasactions. Vol. M. Methods for structural analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

The need for a thorough unified analytical study encompassing all phenomenological and behavioral phases of both projectile and structure under failure coupled with a well documented experimental test data bank is evident to allow extrapolation with much greater confidence beyond the range of the available data. This study was done for the Atomic Energy Control Board of Canada. While our analytical modeling and simulations addressed themselves principally to CANDU Reactor Type outer-containment and to projectiles having low velocities (20-200 m/sec), large diameters (20-140 cm) and large masses (65-3,000 kg) the methodology used can also be used for the study of high velocity (in excess of 300 m/sec), small mass and small diameter (less than 40 cm) projectiles including blast waves.

**394 Thermal hydraulic analysis of Rajasthan Nuclear Power Station primary circuits.** Chaki, S.K.; Bandyopadhyay, S.K.; Singh, A.; Murthy, L.G.K. (Bhabha Atomic Research Centre, Bombay (India)). pp 771-779 of Proceedings of fourth national heat and mass transfer conference 1977 [held at Roorkee]. Meerut, India; Sarita Prakashan (1977).

From 4. national heat and mass transfer conference; Roorkee, India (21 Nov 1977).

This paper presents the complete thermal hydraulic analysis of a pressurised heavy water nuclear reactor system by using principles developed earlier for a BWR system. The code calculates the exact thermodynamic properties at any point in the reactor hydraulic circuit and determines the stable operating point on the pump characteristics.

## 2105 Power Reactors, Breeding

*REFER ALSO TO CITATION(S) 192, 336, 530, 547, 605, 886, 888*

395 (EUR—6813(Vol.2), pp 1188-1202) **Gamma-ray energy deposition measurements in a heterogeneous core and their analysis.** Knipe, A.D.; de Wouters, R. (UKAEA Atomic Energy Establishment, Winfrith; Societe Belge pour l'Industrie Nucleaire, Brussels). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

To confirm the adequacy of present UK photon source data and transport methods for the design of heterogeneous fast reactors, energy deposition measurements were made in the Zebra assembly BZC/1. $^{7}$LiF thermoluminescent dosimeters (TLD-700) were irradiated on the mid-plane along a radial scan traversing two inner breeder islands and a fissile zone, and at the centre of two special steel subassemblies. In the theoretical evaluation the photon sources were calculated from neutron capture, fission and inelastic scattering rates obtained from a multigroup diffusion calculation and normalised to absolute $^{239}$Pu fission rates measured during the irradiations. The Monte Carlo program MCBEND was used to calculate multigroup photon fluxes and the energy deposition distribution. The comparison between the experimental results and calculation shows good agreement for the radial scan, but in the steel subassemblies the calculated energy deposition is about 15% greater than the experimental value.

396 (INIS-mf—6423, pp vp) **Technical and economic aspects of sodium cooled nuclear facilities.** Morcinek, P.; Prnka, T.; Walder, V. (Vyzkumny Ustav Hutnictvi Zeleza, Dobra (Czechoslovakia)); Tatak, V. (Hutni Projekt, Ostrava (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The current state is reviewed of energy sources in the world and future trends are shown of nuclear power. Sodium cooled fast reactors and later also thermonuclear devices appear to be promising. (J.B.)

397 (INIS-mf—6423, pp vp) **Problems of building sodium test circuit at VUZES.** Klemensevic, J.; Tomes, V. (Vyzkumny Ustav Zavodu Energetickeho Strojirenstvi, Brno-Slatina (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The construction is discussed of sodium test facilities at VUZES Brno. The KAS II equipment will be used for testing and calibrating measuring instruments, chemical analyzers and electromagnetic pumps, for function testing new elements of modular steam generators, including heat exchangers with duplex-type heat transfer tubes. The sodium test facility being built since 1975 is a pilot installation featuring conditions approaching those in fast reactor power plants. It will be used for testing models of modular steam generators and their accident protection systems, including models with duplex-type heat transfer tubes. A description is given of the sodium test facility, and its specifications are presented. (B.S.)

398 (INIS-mf—6423, pp vp) **Equipment for long-term testing of material creep in liquid sodium.** Dufek, F.; Walder, V.; Cech, V.; Winkler, P. (Vyzkumny Ustav Hutnictvi Zeleza, Dobra (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

A sodium test plant is described and the methods are shown of securing the desired test specifications. The facility is used for the long-term testing of nonsteady material creep under the action of temperature and mechanical stress due to the static or pulsed overpressure of inert gas inside a tube specimen and a simultaneous effect of sodium flow on the outside wall. The test results are to be used for comparing Czechoslovak-made steels with foreign materials and also for testing the degradation effects of the above phenomena on the standardized long-term properties in inert and steady state conditions. (B.S.)

399 (INIS-mf—6423, pp vp) **Technological research of components and materials using UJV sodium stand.** Sulc, V.; Masek, V. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Banyr, J. (Vyzkumny Ustav Elektrotechnicke Keramiky, Hradec Kralove (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

A brief review is presented of studies conducted within the research of fuel assembly technology for fast reactors. The studies were effected using the experimental S III sodium loop at the Nuclear Research Institute at Rez. (B.S.)

400 (INIS-mf—6423, pp vp) **Simulating thermodynamic effects in liquid sodium reactor facilities using electrically heated fuel element mock-ups.** Masek, V.; Sulc, V. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The concept and methodology are briefly described of model research into thermal inhomogeneities of fast reactor fuel assemblies. The research was conducted by UJV-Rez and FEI-Obninsk in cooperation using the S III sodium loop. The measuring section EK-16 is described in more detail. (B.S.)

401 (INIS-mf—6423, pp vp) **Design of surface heating of experimental sodium facility at VUHZ Dobra.** Cech, V.; Chrastina, M.; Dufek, F.; Lysenko, V. (Vyzkumny Ustav Hutnictvi Zeleza, Dobra (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

Prior to sodium introduction, the facility should be preheated to a temperature exceeding the sodium melting point. EP Hlinsko heating bars of various length were used for heating the pipes while heating sleeves by the same manufacturer were used for heating of vessels. A special heat source was developed allowing the continuous temperature adjustment from 0 degC to the desired temperature. Equipment was designed for testing the service life of Druteva heating bands which had also been used for heating of sodium loops. (M.S.)

402 (INIS-mf—6423, pp vp) **Electromagnetic induction pumps for liquid sodium.** Struckel, P. (Zavody Silnoprudovej Elektrotechniky, Trust Podnikov, Vyzkumny Ustav Energetickeho Strojirenstvi Brno, Odstepny Zavod Kosice (Czechoslovakia)). Apr 1980. (In Slovak). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The principle is described of a helical electromagnetic pump for liquid sodium allowing pumping within 0 to 120 $m^3/h$ at a positive pressure of 500 kPa and a sodium temperature of up to 500 degC. The pump can only transport electrically conductive materials. The induction pump does not comprise any moving parts and the metal inside the helical channel is fully separated from the ambient environment. (M.S.)

403 (INIS-mf—6423, pp vp) **Testing induction pumps on KAS I facility and problems of safety of work in testing plant.** Konecny, A.; Sobotka, J. (Vyzkumny Ustav Zavodu Energetickeho Strojirenstvi, Brno-Slatina (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

A smaller loop was installed in the KAS testing facility for measuring transport characteristics of the prototypes of sodium in-

duction pumps. The loop was equipped with instrumentation for measuring pressure in both the suction and delivery branches, for measuring the flow rate and controlling hydraulic resistance. The questions are discussed of safety in testing and in dismantling and cleaning the pumps. (M.S.)

404 (INIS-mf—6423, pp vp) **Instrument for monitoring activity in liquid sodium.** Jakes, D.; Kral, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The analyzer of oxygen in liquid sodium uses the principle of measuring the difference in potential of a solid state electrolyte galvanic cell. Thorium oxide doped with yttrium oxide was chosen as an electrolyte, an $Sn+SnO_2$ system is used as a reference electrode. The procedure is described in detail for the manufacture of the analyzer. The galvanic cell is capable of long-term operation with an error not exceeding 15%. The recommended operating temperature exceeds 450 degC. (M.S.)

405 (INIS-mf—6423, pp vp) **Continuous analyzers of hydrogen and carbon in liquid sodium and of hydrocarbon total in protective atmosphere above sodium.** Pitak, O. (Chemoprojekt, Prague (Czechoslovakia)); Fresl, M. (Statni Vyzkumny Ustav Ochrany Materialu G.V. Akimova, Prague (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The principle is described of a leak detector for detecting water penetration into sodium in a steam generator. The device operates as a diffusion H-meter with an ion pump. Ni or Fe diffusion diaphragm is washed with sodium while diffused hydrogen is pumped and also monitored with the ion pump. Another detector uses the principle of analyzing hydrocarbons in the cover gas above the sodium level. The carrier gas flow for the analyzer divided into measuring and reference parts is passed through a chamber housing the diffusion standard. For measuring carbon content in sodium, the detector analytical part may be completed with a chamber with moisturizing filling for scrubbing gas. Carbon passing through the diffusion Fe diaphragm is scrubbed on the inner wall in the form of CO which is reduced to methane and measured using the detector C-meter. (M.S.)

406 (INIS-mf—6447, pp vp) **Special spent fuel assemblies packaging method for the Creys-Malville power plant.** Geffroy, J.; Moulin, M.; Dobremelle, M.; Vivien, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Service d'Etudes Mecaniques et Thermiques pour les Reacteurs a Neutrons Rapides); Lemercier, M.; Costa, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides); Joly, J.J. (Novatome Industries, 92 - Le Plessis Robinson (France)); Michoux, M.; Portal, M. (Societe Nucleaire Europeenne a Neutrons Rapides (NERSA), 69 - Lyon (France)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

407 **Sensitivity of light water reactor fuel cycle parameters and costs to uncertainties in thermal nuclear data and methods.** Ryskamp, J.M.; Harris, D.R.; Becker, M. (Rensselaer Polytech Inst, Troy, NY). *Nuclear Science and Engineering;* **77**: No. 3, 285-296(Mar 1981).

The sensitivity of light water reactor (LWR) fuel cycle parameters and costs to uncertainties in thermal nuclear data and methods is examined using a code package. The FASTT code was written to compute detailed sensitivity coefficients using either a direct or a perturbation technique. The code is also used to determine the importance of the frequency distribution used to compute neutron scattering kernels based on the incoherent approximation. 13 refs.

408 **Operating experience in the new irradiated fuel handling and examination cave at the Prototype Fast Reactor, Dounreay.** Edmonds, E.; Higginson, P.R. (UKAEA Dounreay Nuclear Power Development Establishment). pp 235-240 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The facilities at Dounreay Prototype Fast Reactor for the handling and examination of irradiated fuel are briefly described. Operational experience covering normal cave features as well as the special features associated with high decay heat output and under sodium handling are discussed. Further developments in the light of experience gained over the two years since the cave began operating are considered.

409 **Post-irradiation examination on fast reactor fuel elements in France.** Clottes, G.; Peray, R.; Ratier, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Developpement des Elements Combustibles). pp 7-11 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands, on 13-16 May 1980. London; British Nuclear Energy Society (1981).

The subject is discussed under the headings: examination at low burnup values; examination at high burnup values (general considerations on fuel pin examinations, and on hexagonal wrapper examinations; examinations on spent Rapsodie and Phenix fuel subassemblies).

410 **Post-irradiation wrapper measurements of irradiated PFR sub-assemblies at Dounreay.** Campbell, D.A.; Lilley, R.J. (UKAEA Dounreay Nuclear Power Development Establishment). pp 75-80 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Early measurement of Prototype Fast Reactor (P.F.R.) component distortions are an important requirement for operation of Dounreay P.F.R. at high load factor. Equipment has been installed in the P.F.R.Irradiated Fuel Cave for the direct measurement of core components under sodium. In addition a technique has been developed for making quantitative measurements using X-radiography.

411 **Calibration of silicon carbide temperature monitors in a fast reactor.** Sharpe, R.M. (UKAEA Dounreay Nuclear Power Development Establishment). pp 87-90 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Silicon carbide pellets have been used as the standard temperature monitor in uninstrumented rigs in the Dounreay Fast Reactor for 10 years. The irradiation-induced expansion of the $\beta$-silicon carbide was plotted as a function of its post-irradiation anneal temperature, and the temperature at which recovery of the expansion began to take place was taken to be the irradiation temperature. Some recent research, however, suggested that silicon carbide monitor results might not exactly correspond to the actual irradiation temperatures as measured by thermocouples. In the present work, 22 silicon carbide monitors were irradiated against thermocouples in the Dounreay Fast Reactor across the temperature range 425° to 575°C. The monitor results were directly proportional to the corresponding thermocouple readings, but with a constant silicon carbide 'hot bias' of approximately 20 deg C. Using the derived correlation equation, equivalent thermocouple temperatures can be calculated from future monitor results; the 95% confidence limits on an irradiation temperature calculated from the mean result of a group of 3 identically irradiated monitors is +- 20 to 25 deg C.

412 **Development of the equipment for fission gas collection by laser puncturing.** Ogata, Y.; Ando, S.; Karino, M.; Kobayashi, S. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). pp 129-134 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

A technique is described for the measurement of the free volume and gas pressure in fast-reactor type fuel pins. The method employed is to puncture the pin by a laser beam and extract the fission gas into a measuring system with a definite volume. After filling an inert gas with a known pressure, the punctured pin can also be welded by the laser. The filled gas is again released into the measuring system by puncturing the pin and the plenum volume of the pin can be determined. The internal pressure of the fission gas contained within the pin can be calculated from the data obtained. The technique can be applied to the measurements of internal gas pressure contained in pins with several different diameters. The measured error of the system is less than a few percent for free volumes of about 10 $cm^3$.

413 **Application of microprobe analysis to the determination of cladding steels carburization in fast reactor fuel elements.** Cytermann, R.; Perrot, M.; Rouault, J. (CEA, 75 - Paris (France)). pp 161-164 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Cladding carburization of fuel elements irradiated in fast reactors, led to the development of a measurement method for the evaluation of carbon concentration with the use of a shielded electron microprobe CAMECA MS 46. In this paper an account is given of: the specimen preparation, the specific conditions of microprobe analysis; choice of standard specimen, localization of measurement, electronic discrimination, background evaluation; the comparison of different carbon distributions obtained in the case of steels irradiated in various conditions; and a quite simple model of unidirectional diffusion.

414 **Evaluation of void swelling in irradiated L.M.F.B.R. components by density measurement.** Fraser, A.S.; Fulton, E.J. (UKAEA Dounreay Nuclear Power Development Establishment); Little, E.A.; Stow, D.A. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). pp 353-355 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Density measurements provide a rapid and acurate means of assessing the magnitude of irradiation induced void swelling in L.M.F.B.R. core and structural materials. Test procedures currently used within the U.K.A.E.A. are described and the factors governing the accuracy of the determination discussed. Recent trends governing the provision of fully automated remote handling equipment are briefly considered.

415 **Simple comparison of adjusted data sets for iron based on measuremets in ASPIS and in the cores of fast reactor criticals.** Hall, M.C.G. (Imperial Coll. of Science and Technology, London (UK)). pp 79-87 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

The object of this comparison is to determine whether the adjustement sets for iron obtained in one case from integral measurements in ASPIS fission source and in another case from the cores of fast reactor criticals produce the same effect when used in calculations. The reasons that they may produce different effects are: (a) the adjustements may reflect shortcomings in the way integral quantities are calculated from data, for example approximations in transport theory or group averaging errors, rather than errors in nuclear data; (b) the quantities measured in ASPIS and the cores of fast reactor criticals have different sensitivities to iron cross-sections so the adjustements may be complementary rather than equivalent, for example they may span different energy ranges; (c) the standard deviations assumed for the differential data may be unrealistic. Again this will give rise to adjustements which do not reflect real errors in nuclear data.

416 **Application of cross section sensitivity analysis to 'JOYO' main shield.** Ohtani, N. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center); Yamauchi, M.; Itoh, J.; Kawai, M. (Nippon Atomic Industry Group Co. Ltd., Tokyo). pp 157-170 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

Cross section sensitivities of shielding characteristics, such as dose rate or gamma heating rate, in the main shields of experimental test reactor 'JOYO' are studied with linear perturbation theory by ANISN-SWANLAKE code system. With regard to materials, reactions, spatial regions and energy ranges, the kinds of cross sections which exert large influences upon shielding calculations are assessed and the errors of the shielding characteristics due to cross section uncertainties are evaluated. This sensitivity analysis shows that the method is useful for the estimation of the reliability of the shielding design calculation, and for the judgement of the important part of cross sections to reduce the calculational errors.

417 **IHX design for pool type LMFBR system application.** DeFur, D.D. (Combust Eng Inc, Chattanooga, Tenn). *Journal of Engineering for Power;* **102**: No. 3, 563-567(Jul 1980).

This paper presents the design of a 500 MWt Intermediate Heat Exchanger (IHX) for application in a multi-zone pool-type Liquid Metal Fast Breeder Reactor System. The primary feature around which this design was developed is the ability to function under all steady-state and transient conditions without the need for a distinct mechanical feature to accommodate differential thermal expansion between the tube bundle and shell. This is accomplished by using thermal baffles and judiciously adjusting the ratio of shell length in contact with the hot and cold pools of the multi-zone reactor. Thus, the component shell is maintained at a higher temperature than the tube bundle and the tubes are basically tension members. Under certain transient conditions the tubes heat up and become compression members but are not loaded to the point of buckling.

418 **High reliability straight tube LMFBR steam generator design.** Spring, A.H.; DeFur, D.D. (Combust Eng Inc, Chattanooga, Tenn). *Journal of Engineering for Power;* **102**: No. 3, 568-572(Jul 1980).

A new embodiment of the straight-tube counterflow steam generators for LMFBR applications is described which incorporates a number of unique features which contribute to high reliability and availability. These features include a replaceable bellows for accommodation of differential thermal expansion between shell and tubes and a redundant, crevice-free tube-to-tubesheet joint design. The design can also easily incorporate single-wall or double-wall tubes. Single and double-wall tube versions are described whose thermal and geometric size are based on anticipated manufacturing limitations. The results of scoping tests of the tube-to-tubesheet welds are described which provide positive indications of the soundness of the weld design.

419 **Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors.** Ganguly, C.; Roy, P.R. (Bhabha Atomic Research Centre, Bombay (India). Radiometallurgy Section); Seal, A.K. (B.E. Coll., Howrah, Calcutta, West Bengal (India)). pp 423-441 of Proceedings of the symposium on sintering and sintered products [held at] Bombay, October 29-31, 1979. Bombay, India; Department of Atomic Energy (1980).

From Symposium on sintering and sintered products; Bombay, India (29 Oct 1979).

Recent post irradiation examination of a large number of fast breeder reactor fuel pins have revealed satisfactory performance of both low density helium-bonded and high density sodium-bonded (UPu)C, (UPu)N and (UPu)(CN) pins. For the fabrication of these fuels, at all the stages, a high purity inert gas atmosphere, a close control of carbon and nitrogen stoichiometries and minimum plutonium volatilisation losses are to be taken care of. Amongst the different powder metallurgical techniques reviewed, the method consisting of carbothermic reduction of powder mixture of uranium plutonium oxides followed by cold pressing and sintering, offer the versatility of producing both low and high density fuel pins of controlled composition and phase contents. This method has been adapted in Radiometallurgy Division, BARC, for the preparation of plutonium rich (UPu)C, (UPu)N, and (UPu)(CN) fuel pellets.

420 **Hydrodynamic stability tests and analytical model development for once-through sodium heated steam generator.** Kubota, J.; Tsuchiya, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Iwashita, T.; Monta, K. (Nippon Atomic Industry Group Co. Ltd., Tokyo). pp 105-115 of Boiler dynamics and control in nuclear power stations 2. Proceedings of the second international conference held in Bournemouth, 23-25 October, 1979. London, England; British Nuclear Energy Society (1980).

From 2. international conference on boiler dynamics and control in nuclear power stations; Bournemouth, UK (23 Oct 1979).

Hydrodynamic stability tests were carried out using two large capacity, helical coil, once-through sodium heated steam generators (50 MWt), and details of the instabilities were examined. Simple and reliable stability diagrams are presented. Experimental correlations, based on approximately 200 data points of inception condition of instability, predicted the occurrence of the instabilities observed in four kinds of sodium heated steam generators at OEC/PNC with an accuracy of 4 to 10%. A nonlinear, time domain stability analysis code 'BOST' has been developed and successfully verified as the analytical means for the design of sodium heated steam generators.

421 **Prediction of dynamic stability limits of the 45MW scale model of SUPER PHENIX steam generator.** Perrin, J.; Simeon, C. (Electricite de France, 78 - Chatou. Direction des Etudes et Recherches). pp 159-167 of Boiler dynamics and control in nuclear power stations 2. Proceedings of the second international conference held in Bournemouth, 23-25 October, 1979. London, England; British Nuclear Energy Society (1980).

From 2. international conference on boiler dynamics and control in nuclear power stations; Bournemouth, UK (23 Oct 1979).

Among the various tests run on the 45 MW model of SUPER-PHENIX steam generator, erected on the High Power Test Circuit of E.D.F. (CGVS), the problems of dynamic stability were given particular consideration. A systematic search for stability limits was made operating conditions corresponding to SUPER-PHENIX starting level (20% load) and a measurement was performed of the period and amplitude of the waterflow oscillations within the tubes. A linear computation model, called COPI, was developed to reckon the scale model stability limits. After a brief introduction to the model, the theoretical results are compared to the experimental results, the relative difference between the reckoned and measured working factor at the limit of stability is 10% at the most. A survey of the phenomenon was made with the SICLE semi-linear model: by a faithful reproduction of the experimental conditions, flowrate oscillations within the modelled steam generator were obtained in the unit unstable operating areas.

422 **Experimental determination of density-wave oscillations in full-scale sodium-heated steam generators.** Brasz, J. (Nijverheidsorganisatie TNO, Apeldoorn-Zuid (Netherlands). Centraal Technisch Inst. TNO); Van Essen, D. (Neratoom N.V., The Hague (Netherlands)). pp 177-184 of Boiler dynamics and control in nuclear power stations 2. Proceedings of the second international conference held in Bournemouth, 23-25 October, 1979. London, England; British Nuclear Energy Society (1980).

From 2. international conference on boiler dynamics and control in nuclear power stations; Bournemouth, UK (23 Oct 1979).

The stable operation of the SNR-300 steam generators has been demonstrated by a large number of stability experiments with full-scale prototype components in the 50 MW Sodium Component Test Facility at Hengelo in the Netherlands. Instability has only been found under operating conditions different from the design conditions. In this paper a description is given of the stability experiments for the determination of the boundaries of stable operation of the straight-tube and helical-coiled tube prototype steam generators. Beyond the threshold of instability high-frequency oscillation modes as well as flow-reversal phenomena have been observed. At operating conditions with flow instability in a large number of steam generator tubes, a degradation of the overall heat-transfer performance of the component came about.

423 **BESBET 2 - a computer code for the simulation of severe transients in LMFBR boilers.** Thomasson, R.K. (Nuclear Power Co. (Risley) Ltd. (UK)). pp 259-266 of Boiler dynamics and control in nuclear power stations 2. Proceedings of the second international conference held in Bournemouth, 23-25 October, 1979. London, England; British Nuclear Energy Society (1980).

From 2. international conference on boiler dynamics and control in nuclear power stations; Bournemouth, UK (23 Oct 1979).

The main features of a digital simulation of sodium heated boilers for LMFBRs are described, including the method by which reverse or branched steam flows are dealt with. The use of the code is demonstrated by results from the simulation of a double ended dump transient in a once through sodium heated boiler.

424 **Dynamic analyses and control systems for steam generators in LMFBRs.** Kohata, Y.; Furuichi, K.; Sagayama, Y. (Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)). pp 273-280 of Boiler dynamics and control in nuclear power stations 2. Proceedings of the second international conference held in Bournemouth, 23-25 October, 1979. London, England; British Nuclear Energy Society (1980).

From 2. international conference on boiler dynamics and control in nuclear power stations; Bournemouth, UK (23 Oct 1979).

The steam generators (SG) of LMFBRs are divided into once-through-, and recirculating-type. The use of the two different SGs in prototype-LMFBRs design has been influenced by the conventional technique of fossil-fired boilers, but from a control system and plant equipment operations point of view, the type of SG has not been selected, because of no comparative evaluation of dynamic behaviour associated with the two-types. In addition, the operational requirements for post scram control of residual heat removal via SG systems is considered to be an important factor where a choice is made of SG-type. In this paper, a control-, and interlock-system of each of the SG cycles is proposed on the basis of dynamic analysis of recirculating versus once-through type, with regard to post scram control and severity of thermal transient.

425 **Control and operation of the SUPER PHENIX steam generators.** Schneider, J.C.; Skull, G. (Societe Centrale Nucleaire Europeenne a Neutrons Rapides (NERSA), 69 - Lyon (France)); Hery, M. (Electricite de France, 75 - Paris); Debru, M. (Novatome Industries, 92 - Le Plessis-Robinson (France)). pp 281-287 of Boiler dynamics and control in nuclear power stations 2. Proceedings of the second international conference held in Bournemouth, 23-25 October, 1979. London, England; British Nuclear Energy Society (1980).

From 2. international conference on boiler dynamics and control in nuclear power stations; Bournemouth, UK (23 Oct 1979).

The SUPER-PHENIX steam generators and associated control systems have been computer simulated and laboratory tested on a reduced scale model. Simulation techniques and test results are presented in other papers. This paper describes the design strategy of the project and the expected operational performance for the four parallel-coupled generators. Firstly, the gims of the control and operation studies are discussed, namely, automatic operation over a wide working range, load frequency control, failsafe power setback in case of incidents and reduction of stresses on the generators and associated equipments. Afterwards, the influence of these

requirements on establishing operating procedures and the design of generator associated equipments (control system, inlet valves and pumps, protections) are examined. Finally, the principal expected performances in normal and fault operational conditions are described. In particular, the following subjects are dealt with: static and dynamic stability of generators in parallel operation, cold and hot start-up and shut-down; hot standby, large transients, control system and auxiliary equipments failures.

426 **Commissioning and subsequent development of boiler feedwater control systems on the Prototype Fast Reactor.** Bainbridge, A. (Nuclear Power Co. (Risley) Ltd. (UK)); Gray, J. (UKAEA Dounreay Nuclear Power Development Establishment); Lawrence, L.A.J. (UKAEA Atomic Energy Establishment, Winfrith); McAffer, N.T.C. (UKAEA Risley Nuclear Power Development Establishment). pp 411-418 of Boiler dynamics and control in nuclear power stations 2. Proceedings of the second international conference held in Bournemouth, 23-25 October, 1979. London, England; British Nuclear Energy Society (1980).

From 2. international conference on boiler dynamics and control in nuclear power stations; Bournemouth, UK (23 Oct 1979).

The overall control strategy for the Prototype Fast Reactor (PFR) power station is unique, although that part of it which deals with drum level control follows conventional practice. The conventional design is satisfactory for relatively steady conditions but has in practice not reacted well to some transients. This is due partly to certain characteristics of sodium steam generators, but also to features of the plant which do not arise from the association with a fast reactor. A new drum level control system using inputs which take account of sodium conditions as well as water conditions, and using microprocessors to handle the algorithm has been modelled and is now being designed in detail to provide in particular improved control in transient conditions. This together with modifications in the 'conventional' area offer a worthwhile improvement to PFR and a basis for use in future station design.

427 **Performance of a cryogenic distillation system for purifying the argon cover gas in a fast reactor.** Bon Mardion, G.; Dewanckel, B.; Lafon, A.; Verdier, J.; Violet, J.L. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)); Depierre, Y. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). pp 431-442 of Management of gaseous wastes from nuclear facilities. Proceedings of an international symposium jointly organized by the IAEA and the NEA of the OECD and held in Vienna, 18-22 February 1980. Vienna, Austria; International Atomic Energy Agency (1980). (In French)

From International symposium on management of gaseous wastes from nuclear facilities; Vienna, Austria (18 Feb 1980).

The capacity of a cryogenic distillation system to remove the gaseous fission products contained in the argon cover gas of a fast reactor has been demonstrated on a pilot plant. The decontamination factor for krypton and xenon is well above $10^4$. The operation of the plant is not noticeably altered by the introduction of various gaseous impurities such as He, $N_2$, $O_2$, $CH_4$, $CO_2$ and $H_2O$ into the cycle gas.

428 **Self-diffusion study of lithium in molten salt related to molten breeder reactor.** Iwamoto, N.; Tsunawaki, Y. (Osaka Univ. (Japan)). pp 121-125 of Secondary ion mass spectrometry. Fundamentals and applications. Someno, M. (Tokyo Inst. of Tech. (Japan)); Wittru, D.B. Tokyo, Japan; Riaru-Kogeisha Ltd. (Mar 1979).

From 2. Japan-United States joint seminar on secondary ion mass spectrometry; Takarazuka, Hyogo, Japan (23 Oct 1978).

## 2107 Regulation And Licensing

429 **Standardization and the atomic energy law.** Orth, K.; Stubbe, C. pp 141-155 of Technical standardization and law. Papers and discussions. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

All parties involved in the licensing of nuclear power plants are interested in technical rules for the nuclear industry in order to standardize the requirements and to facilities and to improve the licensing procedure which has to put main emphasis on safety engineering. Such rules would help to ease the strain on subsequent legal proceedings, judicial rulings would be easier to predict. The rules set up by the Committee on Nuclear Technology should be incorporated into the Atomic Energy Law. Due to an increasing consolidation of requirements and acceptable solutions from the safety engineering point of view it has now become possible to define rules in nuclear technology which are independent of aspects such as site or specific projects.

430 **Technische normung und recht. Referate und diskussionen. (Technical standardization and law. Papers and discussions).** Berlin, Germany, F.R.; Beuth (1979). vp. (CONF-7906226—).

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

Separate abstracts are presented for each of the conference papers included in the data base.

## 2108 Economics

*REFER ALSO TO CITATION(S) 622*

431 **Recycling of actinides in light water reactors.** Patrashakorn, S.; Papp, R. (Univ of Ariz, Tucson). *Nuclear Technology;* **51**: No. 1, 7-12(Nov 1980).

Coprocessing is conceived as a method in which the plutonium is never available in a separate stream. In addition, it is possible to keep the transuranium actinides with the plutonium and uranium streams rather than allowing them to leave with the fission products and terminate in the high level waste. The recovered actinide product can be reconstructed as a fuel and recycled in light water reactors. But even after nine cycles the fuel composition does not reach equilibrium. Since the plutonium is never separated from other actinides, the potential of proliferation can be reduced. 7 refs.

## 2109 Process Heat Reactors

432 **3-D inelastic analysis of HTR graphite structures and a comparison with A 2-D approach.** Willaschek, J. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.). Abt. Kernelemententwicklung und Auslegung). pp C2/6 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

In High Temperature Reactor Cores (HTR) a large number of elements are constructed of nuclear graphite. The dimensions of the graphite components are limited by stresses and strains resulting from thermal loads, irradiation induced dimensional changes and stress-dependent irradiation creep. Therefore it is necessary to examine the feasibility of design concepts with regard to the structural integrity of the material. This paper presents an analysis of a radial reflector concept for use in a 3000 MWth HTR for process heat production. This concept of a pebble bed reactor (OTTO cycle) requires reflector dimensions and shapes which have previously not been used and which may exceed acceptable stress limits. Graphite reflector elements in a HTR are subject to a high fluence of fast neutrons. The fluence varies spatially within an element. Irradiation-induced strains occur which in turn vary non-linearly with the fluence. At low fluences the graphite shrinks. With increasing fluence shrinkage is saturated and after a 'turn-around' point the graphite begins to swell. The net effect of fluence gradient and irradiation-induced strain is a 'necking' of the element which moves radially outwards with time. In this paper a three-di-

mensional inelastic analysis of a graphite block with the above deformation history is described.

# 22 NUCLEAR REACTOR TECHNOLOGY

## 2201 Theory And Calculation

*REFER ALSO TO CITATION(S) 1638*

433 (EUR—6813(Vol.2), pp 700-707) **Analysis and extension of the SAND-II code.** Guthrie, G.L.; Simons, R.L. (Westinghouse Hanford Co., Richland, WA (USA)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

A method has been devised for including a-priori information about the expected best values of the various group flux levels (together with uncertainties) as part of the input data in the SAND-II code. The modification causes only a minor increase in execution time. In addition, the basic SAND-II algorithm has been analyzed and compared to a least-squares treatment in lognormal statistics. In the case of an over-determined set of linear equations, the basic SAND-II algorithm is shown to give a least-squares solution in a log-normal statistical sense.

434 (EUR—6813(Vol.2), pp 721-731) **Unfolding by least-squares methods: SAND-II, STAY'SL.** Matzke, M. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The mathematical foundation of the SAND-II and STAY'SL unfolding codes used for the determination of neutron flux density spectra from foil reaction rate measurements is discussed. The approximations contained in the STAY'SL program are briefly summarized. In the case of rather large uncertainties of the flux density spectra under test, the assumption of normal distribution which is the basic assumption in the STAY'SL program, can lead to negative spectral flux density values. A modification of the STAY'SL program for this case is proposed. As an example, results of the unfolding programs for the $^{252}Cf$ spectrum are given.

435 (EUR—6813(Vol.2), pp 743-750) **Many channel spectrum unfolding.** Najzer, M.; Glumac, B.; Pauko, M. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The principle of the ITER unfolding code as used for the many channel spectrum unfolding is described. Its unfolding ability is tested on seven typical neutron spectra. The effect of the initial spectrum approximation upon the solution is discussed.

436 (EUR—6813(Vol.2), pp 751-762) **Several applications of J1 unfolding method of multiple foil data to reactor dosimetry.** Nakazawa, M.; Sekiguchi, A. (Tokyo Univ. (Japan). Faculty of Engineering). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

With a view to prepare input data relating to uncertainties of guess-spectra for practical J1 unfolding calculations in a multigroup method, basic properties of neutron spectra are discussed and there are shown two interesting facts, which are the importance to specify the energy resolution to represent the spectrum uncertainties and the appearance of additional uncertainties of group averaged cross-sections due to their spectrum uncertainties wich are used as averaging spectrum. Through considering these facts, it has disappeared some peculiar dependency of final solutions on the computational group structure. Numerical examples of this multigroup J1 unfolding method are shown with some sensitivity analysis results and some discussions on the role of standard neutron fields are also presented.

437 (EUR—6813(Vol.2), pp 779-786) **Multialgorithm unfolding studies of neutron spectra from activation detectors.** Routti, J.T.; Sandberg, J.V. (Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

In many unfolding methods the prior information is built in the solution algorithms and cannot be chosen by the user. The LOUHI type unfolding programs have been developed to alleviate such difficulties with the algorithms described below.

438 (EUR—6813(Vol.2), pp 787-806) **Comparison of four neutron spectrum unfolding codes.** Zijp, W.L.; Nolthenius, H.J. (ECN, Petten (Netherlands)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

This report describes the main results, obtained in the past few years with the following neutron spectrum unfolding codes: SAND-II, CRYSTAL BALL, RFSP-JUL and STAY'SL. The emphasis lies here on the practical experience with application of these codes under comparable conditions. A large part of the comparison work was performed under research contract with the IAEA (contract number 1811/R1/R8).

439 **Application of the method of characteristics to solution of nuclear engineering problems.** Weisman, J.; Tentner, A. (Univ of Cincinnati, Ohio). *Nuclear Science and Engineering;* **78**: No. 1, 1-29(May 1981).

A critical overview of the method of characteristics (MOC) and its application to nuclear engineering problems is provided. After examining the mathematical basis of the method, its application to both single- and two-phase flow transients is described. Application of the MOC to neutronics calculations is also considered. An important, but often overlooked, ability of the method is the provision of analytical solutions for transients where only two conservation equations need to be considered. These applications, as well as all of the other major applications of the MOC, are described. 83 refs.

440 **Analysis of the Winfrith iron benchmark experiment with DUCKPOND and comparison with the ANISN/SWANLAKE analysis.** McCracken, A.K. (UKAEA Atomic Energy Establishment, Winfrith). pp 373-380 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

The inclusion Monte Carlo statistics into a linear adjustement procedure poses little difficulty and two algorithms, PERTAK and DUCK, which do this have been discussed. Both have been applied to measurements in the Winfrith iron benchmark experiment in conjonction with the perturbation Monte Carlo code; results from both algorithms agreed very closely. Both methods can make use of iterative refinement, but DUCK gives an earlier indication of the point at which iteration should cease and this is the algorithms which has been included in DUCKPOND. Deep penetration measurements are those which focus attention sharply on defects in nuclear data but a rather large stochastic uncertainty is likely in the Monte Carlo prediction of such measurements. As the refinement of nuclear data is inhibited by Monte Carlo statistical uncertainties, we can see that highly efficient variance reduction strategy is most desirable in Monte Carlo perturbation.

441 **Preliminary version of the EURLIB variance-covariance matrices.** Hall, M.C.G. (Imperial Coll. of Science and Technology, London (UK)). pp 61-71 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

Covariance matrices for iron and sodium have been provided in the EURLIB group scheme from basic information given in a

compilation, done at ORNL, of multigroup cross section covariance matrices for several important reactor materials. More complicated, and perhaps more realistic, expansions of the basic data can be postulated. These simple expansions have been produced in te spirit that they will encourage rigorous methods of calculating errors in readiness for the time when covariance information is supplied as a matter of course with evaluated nuclear data.

## 2202 Components And Accessories

*REFER ALSO TO CITATION(S) 309, 310, 369, 599, 660, 665, 666, 670, 681, 690, 731, 842*

442 (AECL—6885, pp 1 - 7) **Vibrational and fretting wear of heat exchangers.** Ko, P.L.; Pettigrew, M.J.; Wolgemuth, G.A.; Campagna, A.O. Mar 1980. Dep. NTIS (US Sales Only).

From Canadian Nuclear Association heat exchanger reliability seminar; Toronto, Canada (1 May 1980).

This paper presents a flow-induced vibration analysis technique and a procedure to predict fretting wear damage from experimental data. Examples are used to illustrate these techniques.

443 (AECL—7056, pp 282-289) **Distributed systems for the protection of nuclear stations.** Jover, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1980. (In French). Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

The advantages of distributed control systems usually mentioned are improved exploitation, cost reduction, and adaptation to changes in technology. These advantages are obviously very interesting for nuclear power plant applications, and many such systems have been proposed. This note comments on the application of the distributed system concept to protection systems - what should be distributed - and closes with a brief description of a protection system based on microprocessors for pressurized water stations being built in France.

444 (EUR—6813(Vol.1), pp 93-107) **Si reactor damage monitors and their application.** De Leeuw, S.; Fabry, A.; Menil, R.; Tourwe, H. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

P.I.N. silicon diodes and quartz damage monitors are well suited to complement conventional flux-fluence monitors in the range Esub(n)> =100 keV. When using Si-P.I.N. diodes as fluence monitors an accuracy of 8 to 10% can be expected when Ksub(F) is determined from the characteristics of a large sample of the population. Better accuracy can be achieved by individually calibrating the diodes in a fission spectrum subsequent to irradiation in the unknown environment. Partial isothermal annealing of the diodes at 45°C for 2 to 3 days minimises room temperature effects.

445 (IWGHTR—2, pp 79-83) **Basic design of the Krupp heat-insulating system with hot liner for PCPVs of HTRs.** Spandick, W. (Krupp (Friedr.) G.m.b.H., Essen (Germany, F.R.). Forschungsinstitut). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

Presented is the design of a heat-insulating system incorporating a so called "hot" liner for use with high temperature reactors. The liner is in direct contact with the coolant, has a thickness of between 10 and 15 mm and is arc welded to anchors embedded in the concrete. Thermal cyclic tests were performed and incipient cracks were detected after about 5000 cycles; the liner is to be designed for between 800 and 1400 cycles. The liner design allows for internal inspection and, if necessary, repair at all times. Tests have shown the advantages of the design provided liner temperatures do not rise above 300°C.

446 (IWGHTR—2, pp 106-114) **Experimental verification of a PCPV concept with elastic hot liner and regulated wall temperature.** Hinterleitner, H. (Reaktor Forschungs- und Baugesellschaft m.b.H., Seibersdorf (Austria)); Witt, A. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Forschungszentrum). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

Work is reported on the testing of a prestressed concrete pressure vessel with elastic hot liner and adjustable wall temperature. The different aspects of the testing program included liner technology as a result of which martensitic high-strength steel was chosen for the liner; concrete technology to develop insulating concretes to withstand temperatures to 350°C and standard concretes for temperatures to 150°C; prestressing steel technology as a result of which so-called stabilized wires were chosen as strain losses were shown to be less than for non-stabilized wires. A working temperature limit for these wires seems to be 200°C, thus temperature limit for prestressed structures is set by the prestressing steel rather than the concrete. An experimental ring representing a 1 m high section of the cylindrical part of the vessel was built and tested; further tests are continuing. A prototype vessel was then constructed and various tests carried out. These include thermal tests as well as pressure tests. Further tests will simulate realistic HTR operating conditions at helium temperatures up to 1000°C and liner temperatures of 300°C.

447 (IWGHTR—2, pp 126-136) **Non-linear calculation of PCRV using dynamic relaxation.** Schnellenbach, G. (Zerna-Schnellenbach, Consulting Engineers, Bochum, Germany, F.R.). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

A brief review is presented of a numerical method called the dynamic relaxation method for stress analysis of the concrete in prestressed concrete pressure vessels. By this method the three-dimensional elliptic differential equations of the continuum are changed into the four-dimensional hyperbolic differential equations known as wave equations. The boundary value problem of the static system is changed into an initial and boundary value problem for which a solution exists if the physical system is defined at time t=0. The effect of non-linear stress-strain behaviour of the material as well as creep and cracking are considered.

448 (IWGHTR—2, pp 161-175) **Experiences with testing PCRV concrete and epoxy resin models.** Schimmelpfennig, K.; Schnellenbach, G. (Zerna-Schnellenbach, Consulting Engineers, Bochum, Germany, F.R.). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

A 1:5 scale model of a prestressed concrete pressure vessel was used to investigate its operating behaviour when only partially prestressed so as to allow cracking even under operating conditions. Further experimental work consisted in the building and testing of epoxy resin models to check the results of three-dimensional numerical calculations. Results show that a partially prestressed vessel will operate reliably and that deformations under both short and long-term internal pressure are essentially reversible. The results from the epoxy resin models show that building such models also with complicated geometries and with embedded strain gauges can be successfully carried out and that testing such models is a good tool for checking computer calculations.

449 (IWGHTR—2, pp 183-189) **Monitoring of prestressed concrete pressure vessels for nuclear reactors.** Cochrane, H.B. (Central Electricity Generating Board, Barnwood (UK). Generation Development and Construction Div.). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

The paper (1) "Experience of In-Service Surveillance and Monitoring of Prestressed Concrete Pressure Vessels for Nuclear Reactors", which was presented by Irving at the York Conference in September 1975, gave details of the statutory requirements for the inspection of prestressed concrete pressure vessels in the United

Kingdom, with particular emphasis on the prestressing system. Results were presented of periodic examinations under the Licensing Conditions for the vessels at the gas cooled Magnox reactors at Oldbury and Wylfa, which had been operating since 1967 and 1971 respectively, and these were discussed in relation to design expectations and future requirements. The paper also gave strain, moisture and temperature readings obtained from Oldbury PCPVs over a ten year period and compared these with predictions. The purpose of this paper is to update the information presented in the 1975 York paper by summarizing the results which have been obtained since then up to the present time (1978). The results are summarized below under six headings.

450 (KFTI—79-65, pp 86-87) **Target heater for the experiments on the reactor damage simulation in accelerators.** Khorenko, V.K.; Cherni, B.P.; Mashkarova, V.G.; Ryabchikov, L.N. 1979. (In Russian). Dep. NTIS (US Sales Only).

In Radiation damage physics and radiation technology. No. 3(11).

A design of a sample heater, used in an accelerator, for material testing to irradiate targets at high temperatures is described. The accuracy of temperature control on samples constitutes +- 1% in the 300 to 800°C range. The heater design makes it possible to reduce to minimum gas release from the heater parts into the target chamber. A reliable thermal contact of samples with the heater is achieved due to the snap-in clamping of samples providing good reproducibility of temperature measurement at multiple heatings and coolings. The target heater complies with the requirements for similar devices used in experiments simulating the swelling of structural materials in accelerators.

451 **SAMPO: a code system giving different orders of approximation for sensitivity and perturbation analysis.** Estiot, J.C.; Salvatores, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)); Palmiotti, G. (Nucleare Italiana Reattori Avanzati SpA (NIRA), Genoa (Italy)). pp 221-235 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981). (In French)

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

We present the characteristics of SAMPO, a one dimension transport theory code system, which is used for the following types of calculation: sensitivity analysis for functional linear or bi-linear on the direct or adjoint flux and their ratios; classic perturbation analysis. First order calculations, as well higher order, can be presented.

452 **Iterative multigroup cross-section adjustment procedure.** Matthes, W. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). pp 363-371 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

The method of 'Least Squares' was programmed to adjust cross sections in the analysis of Benchmark experiments. To test the efficiency and reliability of this method computer-simulated (Benchmark -)experiments are investigated.

453 **Utilization of thermocouple random signal correlation method for coolant flow rate measuring in nuclear power plants.** Selivanov, V.M.; Martynov, A.D.; Prostiakov, V.V.; Solopov, A.P.; Karlov, N.P.; Tregubov, V.B.; Sharypin, V.I. (Obninsk Institute of Physics and Power Engineering, USSR); Pallagi, D.; Horanyi, S.; Hargitai, T. pp 283-290 of Measurement for progress in science and technology. Volume 3. Proceedings of the 8th IMEKO congress of the International Measurement Confederation held in Moscow, USSR, 21-27 May 1979. Solt, J.; Kemeny, T. (eds.). Amsterdam, Netherlands; North-Holland (1980).

From 8. IMEKO congress; Moscow, USSR (21 May 1979).

Results of experimental studies on mastering the use of correlation method for coolant flow rate measuring are presented. Distribution of temperature pulsation intensity over the cross-section of the flow is analyzed. Plots of temperature noise level versus a distance to its source are given and the influence of averaged flow characteristics on the temperature pulsation intensity is shown. Recommendations on choice of basic distance between the thermocouples in primary transducers are given. Description of the NZ-664 type flowmeter is presented.

454 **Chemical inhomogeneity of large forging ingots.** Zdenek, K.; Lydie, B.; Miloslav, K.; Karel, M.; Jiri, M. pp 279-283 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

The Skoda concern at Pilsen was entrusted with the production of pressure vessels for nuclear reactors. Consequently, the Central Research Institute of the Skoda works became involved in metallurgical research directed toward improving the quality of steels destined for these vessels. In order to determine the optimum forming technology for the 135 t weight ingots used for pressure vessel ring forgings, the macrostructural and chemical inhomogeneities of these ingots were analysed in detail. The target of the research was to verify in detail the distributions of elements tending to segregation as well as the steel purity as to the contents of non metallic inclusions and trace elements, and to determine the optimum forging technology.

455 **Creep tensile instability.** O'Donnell, W.J.; Porowski, J.S. (O'Donnell and Associates, Inc., Pittsburgh, PA (USA)). pp 33-42 of Fourth international conference on pressure vessel technology. Volume 2. Design, analysis, components, fabrication and inspection. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

Creep tensile instability solutions are obtained herein for most cases encountered in design applications. These include: (1) membrane load stresses of arbitrary biaxiality, (2) pressurized spherical vessels, and (3) pressurized cylindrical vessels and piping with combined axial loads. Solutions are obtained for both the effective (Mises) strains and the maximum tensile strains at instability. The results show that neither Triaxiality Factors nor factors based on plastic tensile instability solutions can be used to convert creep rupture ductility data to safe allowable design values for components operating in the creep regime. The present solutions can be used to obtain allowable strains for design applications using available uniaxial creep rupture ductility data.

456 **Radiation damage saturation in reactor pressure vessel steel. Data and preliminary model.** Stahlkopf, K.E.; Marston, T.U. (Electric Power Research Inst., Palo Alto, CA (USA)); Odette, G.R. (California Univ., Santa Barbara (USA)). pp 265-272 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

The purpose of a surveillance program in a nuclear reactor pressure vessel is to provide an accurate measure of the changes in properties with irradiation. These properties are necessary to assess the structural integrity of the beltline region of the vessel as it is subjected to neutron irradiation damage. In 1978, some data from commercial reactor surveillance programs suggested that radiation damage to the beltline region of the reactor pressure vessel may not be as great as predicted by current regulatory guidelines. These data suggest that saturation in both degradation of Charpy upper shelf energy and transition temperature occurs at fluences in the mid $10^{18}$ n/cm$^2$ range. The saturation effect, simply stated, is as follows: in low flux irradiations, the normal manifestations of embrittlement (change in transition temperature, change in Charpy upper shelf energy, and change in flow properties) are affected only up to some level of exposure and any subsequent exposure does not affect these properties. This is in contrast to high flux irradiations where

the manifestations of embrittlement are proportional to fluence and no saturation is observed. Available data are presented and discussed, and recommendations made.

457 **Replacement of hard coating in nuclear values: results of testing of cobalt free valves.** Vignaud, J.C. (Electricite de France, 77 - Ecuelles). pp 139-145 of Colloque international sur les materiaux durs pour frottement dans les reacteurs nucleaires, Avignon, 25-26 septembre 1980. Paris, France; SFEN (1980). (In French)

From International colloquium on hard-facing materials in nuclear power plants; Avignon, France (25 Sep 1980).

Tests on true valves in a loop are compared with laboratory friction tests and show the possibility to obtain cobalt free valves.

458 **Design and fabrication to assure vessel integrity.** Ruf, R. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 3-21 of Assuring structural integrity of steel reactor pressure vessels. Steele, L.E. (Naval Research Lab., Washington, DC (USA)); Stahlkopf, K.E. (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Systems and Materials Dept.) (eds.). London, England; Applied Science (1980).

From 1. international seminar on assuring structural integrity of steel reactor pressure vessels; Berlin, F.R. Germany (20 Aug 1979).

The integrity and reliability of the pressure vessel of a nuclear reactor is a dominant object in West Germany in all public discussions concerning safety of nuclear power plants. In West Germany, therefore, it has been evident for many years that in designing and manufacturing pressure vessels for nuclear power plants, precautions have to be taken by which - at least in a technical sense - a catastrophic failure can be, with absolute safety, excluded. The subject is discussed under the headings: design considerations; vessel manufacturing considerations.

459 **Assuring structural integrity of steel reactor pressure vessels.** Steele, L.E. (Naval Research Lab., Washington, DC (USA)); Stahlkopf, K.E. (eds.). London, England; Applied Science (1980). vp. (CONF-7908154—).

From 1. international seminar on assuring structural integrity of steel reactor pressure vessels; Berlin, F.R. Germany (20 Aug 1979).

Selected papers were indexed separately.

460 **Analysis of colliding vibration of two cylinders.** Ghosh, A.K.; Grover, R.K.; Kakodkar, A. (Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.). pp D4/7 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. D. Structural analysis of reactor fuel elements and assemblies. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Failure of few end plates was observed during reactor operation in 1975. To investigate into the causes of this failure, a program of theoretical and experimental studies was undertaken. In order to evaluate the deformation characteristics of the end plate under various loading and support conditions, it is necessary to analyse the fuel bundle as a structure. The computer code SPACE was developed which is capable of performing three dimensional force-displacement analysis. The structure is assumed to be a rigid jointed space-frame consisting of members which are assumed to behave as elastic bodies. The bundle structure was divided into 79 members with 52 nodes. The shear deformation in the member is neglected. The joints of the structure have six degrees of freedom consisting of three translations and three rotations. The program consists of the main program SPACE and five sub-routines, namely, ANAL, STIFF, MEF, MODIFY and SOLVE. The simultaneous equations obtained from the relationship of the stiffness matrix, displacement matrix and load matrix are solved by using Gauss elimination solution. Three different loading conditions have been studied. The code predictions compare well with the actual simulated tests carried out.

461 **2- and 3-dimensional elasto-plastic finite element analysis of an SENB fracture specimen.** Adams, N.J.I. (British Petroleum Co. Ltd., London). pp G2/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. G. Structural analysis of steel reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Much of the basic materials data on which the application of fracture mechanics rests, is derived from the theoretical analysis of two dimensional models. Recent three dimensional elastic finite element analyses have revealed crack tip singularity behaviour different from that previously postulated. This has permitted a rational analysis of fracture test results that were thought questinable. It was considered that because many nuclear components may have failure modes in the elasto-plastic regime, that a three dimensional analysis of a standard test specimen could be of value in quantifying the fracture initiation process. A finite element model of a single edge notch bend specimen, with a relatively coarse mesh has been used to carry out the analysis employing the MARC finite element package. Exactly the same element configuration has been analysed for the two dimensional plane stress and plane strain cases to provide a comparison.

462 **Structural collapse due to plastic instability.** Tvergaard, V. (Danmarks Tekniske Hoejskole, Lyngby. Dept. of Solid Mechanics); Needleman, A. (Brown Univ., Providence, RI (USA). Div. of Engineering). pp L1/3 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Nehterlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In a number of circumstances the collapse and failure of structures is due to bifurcation of the load-deflection-path, as in the buckling failure of thin walled plate and shell structures subject to compressive loading. The aim of this paper is to give an overview of what is known theoretically about bifurcation induced structural collapse in which plastic deformation plays a significant role. This includes not only situations in which bifurcation takes place in the plastic range, but also situations in which plastic deformation limits the maximum support load of a structure that bifurcates in the elastic range. Particular emphasis is given to recent progress that has been made, in both analytical and numerical studies, in elucidating the combined effects of material nonlinearity and structural imperfections.

463 **High-temperature design of elastic-plastic structures.** Gokhfeld, D.A. (Chelyabinskij Politekhnicheskij Inst. (USSR)). pp L2/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Progress in solid mechanics, particularly in its branches dealing with high temperature design has been intensively stimulated by the development of modern technology during the last decades. Two main approaches to strength evaluation of elastic-plastic structures subjected to cyclically variable loads and heat fluxes can be distinguished now. The first one is based on a well known concept according to which a preliminary determination of local stresses, strains and displacements and their amplitudes and increments is an integral part of strength estimation. As a foundation of the second approach the limit analysis of elastic-plastic structures is used.

464 **Inelastic analysis of structures with applications to cyclic loadings.** Zarka, J.; Engel, J.J.; Inglebert, G. (Ecole Polytechnique, 91 - Palaiseau (France). Lab. de Mecanique des Solides). pp L3/2 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The paper is concerned with the derivation of cyclic constitutive relations of materials during inelastic regime and the development of the eventual periodical state in a cyclically loaded structure.

465 **Simplified methods in inelastic analysis.** BarGoum, R.S. (Combustion Engineering, Inc., Windsor, CT (USA). Engineering Science Dept.). pp L10/2 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In this paper simplified methods in inelastic of time-independent and time-dependent deformations are surveyed. The review covers bounding methods, simplified elastic methods, some novel approaches, geometry simplification, and material simplification. They cover, creep and fatigue damage, ratcheting, ductile and creep rupture failure modes. Verification of these methods by detailed inelastic analysis and experiments for various componet geometries, test specimens and loading conditions is discussed.

466 **Material damage in structural analysis.** Hult, J.; Janson, J. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Div. of Solid Mechanics). pp L11/1 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The paper gives a survey of the development of continuous damage mechanics during the 20 years following the originating paper by Kachanov in 1958.

467 **Behaviour of plates subjected to steady mechanical load and rapid thermal transients on both surfaces.** Goodman, A.M.; Phillips, J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp L11/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper presents the results of computer calculations which investigate the effect of rapid double-sided thermal downshocks on the performance of a 'Bree plate'. The computations include analysis of elastic, plastic, thermal and creep strains and deformations. The accumulation of creep and fatigue damage is calculated from the resulting stress and strain distributions using linear damage summation rules. Simple constitutive equations are employed in the absence of reliable data on material behaviour under the types of loading considered.

468 **Creep buckling and instability of circular cylindrical shells in axial compression.** Murakami, S.; Tanaka, E. (Nagoya Univ. (Japan). Dept. of Mechanical Engineering). pp L12/1 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The present paper is concerned with the theoretical and the experimental investigation into the instability in creep buckling of real circular cylindrical shells with special emphasis on the initiation of non-axisymmetric mode of deformation. Clamped aluminium circular cylindrical shells of radius to thickness ratio $\alpha = 50$ and 100 under constant axial compression at 200°C are chosen.

469 **Structural beam shapes under cyclic inelastic loads.** Krishnasamy, S.G. (Ontario Hydro, Toronto (Canada). Research Div.); Kennedy, N.A.; Sherbourne, A.N. (Waterloo Univ., Ontario (Canada). Dept. of Civil Engineering). pp L13/5 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Structural shapes have been found to become unstable due to accumulated permanent strain under cyclic inelastic loads. The paper describes a programme in which 10 small rolled I-beams are subjected to fully reversed strains at the outer fibres ranging from +-0.11% to +-0.45% under pure bending conditions. The material softens under cyclic straining leading to premature flange instability when the control strain exceeds 3 times the yield strain of the material. In contrast, under static loading, the beam does not exhibit any instability even though the strain may exceed 10 times the yield strain. Moment-strain relations have been developed for predicting behaviour of simple structures under alternating deflections.

470 **Choice of the method and reagents for maintenance washing and decontamination of the NPP equipment.** Bogus-lyavskij, V.B.; Gruzdev, N.I.; Sklyarov, V.P.; Shiryaev, V.N.; Shchapov, G.A. pp 27-34 of Radiatsionnaya bezopasnost' i zashchita AEhS. Vypusk 3. Egorov, Yu.A.; Mashkovich, V.P.; Pankrat'ev, Yu.V.; Tsypin, S.G. (eds.). Moscow, USSR; Atomizdat (1977). (In Russian)

In order to perfect the decontamination technology of nuclear power plant equipment, investigations have been carried out with the aim to elucidate the effect of various decontaminating solutions or the decontamination efficiency. These also involve studies on the dispersed state of corrosion product radionuclides in the decontaminating solutions. Corrosion behaviour is evaluated for construction materials of the equipment. A double-bath reduction-oxidation procedure has been tested for removal of metal oxide deposits. The investigation results show that the efficiency of decontamination reaches its maximum at concentration of alkali NaOH 5%, $KMnO_4$-0.5% and that of oxalic acid $H_2C_2O_4$-3%. The treatment of the samples with alkalin solution of potassium permanganate dissolves practically all the nuclide $^{51}Cr$. Corrosion behaviour of the main materials for a nuclear power plant loop (corrosion resistant steel, nichrome) indicates that the corrosion occurs uniformly while the corrosion rate has been recongnized to be permissible for the equipment.

## 2203 Fuel Elements

*REFER ALSO TO CITATION(S) 277, 279, 298, 299, 300, 301, 302, 303, 304, 305, 306, 342, 346, 347, 348, 349, 350, 351, 352, 353, 409, 410, 413, 552*

471 **(IWGFPT—7, pp 36-44) Simple treatment of fission gas for normal and accident conditions.** Matthews, J.R.; Wood, M.H. (UKAEA Atomic Energy Research Establishment, Harwell). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A set of simple modules have been developed to describe fission gas release and swelling in oxide nuclear fuels for use in fuel behavior codes. The methods used are simplifications of earlier more detailed work and contain several important developments that allow for improved accuracy over earlier simple treatments and the description of the fission gas bubble population with little penalty in computer time or storage. The three modules are: (1) intragranular fission gas behavior during normal operation, which treats gas bubble nucleation, growth and destruction by fission fragments and the diffusion of gas to the grain boundaries by single gas atom diffusion, (2) intragranular fission gas behavior during rapid transients which treats the migration and coalescence of gas bubbles, the sweeping up of fission gas atoms by bubbles and the drift of gas bubbles to the grain boundary under the driving force of the temperature gradient, and (3) intergranular fission gas behavior, which treats the growth and interaction of face and edge bubbles on the grain boundary, their interlinkage and gas release. All these

models allow for transient behavior and are compared with experimental observations of both macroscopic swelling and gas release (and retention) and microscopic observations of bubble sizes and concentrations.

472 (IWGFPT—7, pp 56-66) **Treatment of numerical problems due to rapid creep rate in the fuel performance calculation by FEM.** Nuno, H.; Ogawa, S.; Sato, T. (Mitsubishi Atomic Power Industries, Inc., Omiya, Saitama, Japan). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

In the fuel rod performance calculation using FEM, one often encounters numerical problems arise from very rapid creep rate especially in the high temperature region of pellets; that means extremely small time increments are required to keep the calculation stable enough and this actually makes the calculation almost impossible. Authors tested several numerical methods that were considered to be effective to the present problem. They were: Constant Stress, Constant Total Strain, Softened Stiffness, and Iteration methods. The test calculations were done on 3 kinds of pellet and rod model; single element ring with displacement-controlled and force-controlled types of loading, a 3-element pellet with thermal stress loading and a fuel rod under a high power ramp loading. From the above results it was found that Softened Stiffness method was promissive for general types of loading and that Constant Total Strain method was also practical for displacement controlled type loadings such as thermal stress or PCI loading. In the course of the above study, authors tried the usefulness of a concept of creep-time-constant for predicting the stability of creep calculation, and found that it could be a convenient measure for meshing the time steps. Although the present study was limited to pellet creep, the results are considered to be applicable to clad creep. The above mentioned 4 methods are embedded in the FROST code as optional use, and the code has been utilized to analyze PCI performances of LWR fuel rods.

473 (IWGFPT—7, pp 76-96) **Steady state fission gas kinetics in nuclear fuel at lower temperatures.** Blank, H.; Caligara, F.; Ray, I.L.F. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

Information on fission gas behaviour in nuclear fuels on a micro-scale can be obtained by analysing the fission gas bubbles in irradiated fuels by transmission electron microscopy. Published and our own results by this technique on $\alpha$-U, advanced fuels and oxide fuels are compared on the basis of a common temperature scale T/T/sub m/ (T/sub m/ melting temperature of the fuel). The intragranular fission gas kinetics has to be analysed by taking account of fuel restructuring. Fuel restructuring in advanced fuels and in LWR fuels under the condition of normal heat ratings is very similar. Metallic conducting fuels (metal fuel and advanced fuels) show very similar kinetics at equivalent temperatures T/T/sub m/ which can be treated at $T <= 0.5$ T/sub m/ with a simple model based on homogeneous bubble nucleation and weak fission gas re-solution. Oxide fuels on the other hand must be treated under the aspect of strong fission gas re-solution and heterogeneous bubble nucleation. Above T approximately 0.65 T/sub m/ possibly homogeneous nucleation is valid also in oxides.

474 (IWGFPT—7, pp 96-102) **In-pile measurements of pellet cladding interaction and relaxation.** Vilpponen, K.O. (Institutt for Energiteknikk, Halden (Norway). OECD Halden Reaktor Prosjekt). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

In-reactor measurements related to pellet cladding interaction and relaxation have been presented. Particular emphasis has been placed on the elastic strains, which can only be measured by in-reactor instrumentation. It has been demonstrated that fuel densification may reduce mechanical interaction during the early life irradiation of fuel rods. The benefit may, however, be lost by increased fission gas release which contaminates the gap gas leading to increased fuel temperatures. The feedback effect can occur very rapidly and even relatively mild power shocks can trigger the process. The combined mechanical and chemical shock during power transients may result in rod failure. However, when the cladding strain relaxes fast enough during the ramp, or if relaxation is allowed by using a slow ramp rate, defects can be avoided. In-reactor relaxation measurements have indicated that during the start-up phase, relaxation is very pronounced and directly related to fuel densification. In such cases total relaxation was observed to occur in the course of less than a few days at power, whereas at higher burn-up for similar power levels the fuel is more rigid and complete relaxation may require months at steady state operation.

475 (IWGFPT—7, pp 103-108) **Theoretical free energies for superplasticity and dislocation creep. The origin of the high ductility in superplastic flow.** Gittus, J.H. (UKAEA Springfields Nuclear Power Development Labs.). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

In certain types of reactor transient the Zircaloy cladding on LWR fuel elements is caused to swell by the internal gas pressure. The amount of swelling is determined by the ductility of the clad, itself a function of internal and external stabilizing and destabilizing mechanisms. An internal stabilizing mechanism is superplastic flow and in this paper we consider the conditions that lead to this process of deformation and the origin of the resultant high ductility. During dislocation creep the dislocations often arrange themselves in cells. The cell size rises if the stress causing creep is reduced and eventually the cell size becomes equal to the grain size. Superplastic flow then becomes the main deformation mechanism. The free energy of a specimen undergoing dislocation creep is calculated and proves to be generally much higher than that of a specimen deforming superplastically at the same rate. Only at high strain rates does the situation reverse. Accordingly the superplastic condition, once established, persists and neck-propagation is strongly resisted until a late stage, by which time large elongations will have occurred.

476 (IWGFPT—7, pp 108-117) **Development and correlation of cladding creep and irradiation growth models.** Wilson, H.W.; Hsieh, H.J.; Yoon, K.K. (Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Generation Div.); Clevinger, G.S. (Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div.). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

An accurate model for defining cladding deformation is required when performing fuel rod performance analyses. Cladding deformation models are used in cladding ovalization analysis as well as general fuel pin analyses of fuel temperatures, fission gas release, pin pressures, etc. Accurate creep models also are required to analyze the transient multi-axial stress histories which develop in the fuel rod cladding during Pellet Cladding Interaction. Of particular interest for normal operation analysis is the deformation resulting from cladding creep and irradiation growth. The development of these models and their correlation with operating data are discussed.

477 (IWGFPT—7, pp 118-123) **Evaluation of gas release modelling approaches as to their applicability in fuel behaviour models.** Mattila, L.J.; Sairanen, R.T. (Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

The release of fission gas from uranium oxide fuel to the voids in the fuel rod affects in many ways the behavior of LWR fuel rods both during normal operating conditions including anticipated transients and during off-normal and accident conditions. The current trend towards significantly increased discharge burnup of LWR fuel will increase the importance of fission gas release considerations both from the design and safety viewpoints. In the paper fission gas release models are classified to 5 categories on the basis of complexity and physical sophistication. For each category, the basic approach common to the models included in the category is

described, a few representative models of the category are singled out and briefly commented in some cases, the advantages and drawbacks of the approach are listed and discussed and conclusions on the practical feasibility of the approach are drawn. The evaluation is based on both literature survey and our experience in working with integral fuel behavior models. The work has included verification efforts, attempts to improve certain features of the codes and engineering applications. The classification of fission gas release models regarding their applicability in fuel behavior codes can of course be done only in a coarse manner. The boundaries between the different categories are vague and a model may be well refined in a way which transfers it to a higher category. Some current trends in fuel behavior research are discussed which seem to motivate further extensive efforts in fission product release modelling and are certain to affect the prioritizing of the efforts.

478 (IWGFPT—7, pp 124-132) **Model for simulating non-equilibrium fission gas behaviour.** Esteves, R.G. (NUCLEBRAS, Rio de Janeiro (Brazil)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A new model for predicting the fission gas behavior in oxide fuel elements undergoing fast thermal transients is presented. The major feature of this model is to analyze the equilibrium as well as the non-equilibrium fission gas behavior. This formulation introduces a new variable, equilibrium variable (EV) which, together with bubble radius r, completely specifies a fission gas bubble with respect to its size and equilibrium condition. Formulae and theorems that govern the variation and value of EV when the temperature is changed and/or when bubbles with different conditions interact, are derived. The phenomena as bubble migration, coalescence, re-solution, gas release, and volume adjustment by flow of vacancies and interstitials is reanalyzed under the new formulation and a two-variable multigroup theory is proposed. A code applying this model is used to simulate the measurements in two TREAT Transients with peak temperatures of 2477 and 2000 K as well as in the H3 TREAT transient as analyzed by Stahl and Patrician. The computations are in fair agreement with the observations for bubbles smaller than 964 $A^0$ in diameter but not for large bubbles, unless the effects of solid fission products are taken in due account. In all simulations, bubbles that grew during heat-up phase of the transient were found to be frozen at a larger than equilibrium size during the cooldown phase of the transient. This phenomenon can significantly affect post-transient swelling and gas release. It is also found that the assumption of equilibrium can introduce considerable error in the computed bubble distribution, swelling and gas release at the end as well as at post fast thermal transients. The steady state calculation suggests that a non-equilibrium treatment might be necessary for the calculation of fission gas behavior even under normal operating conditions.

479 (IWGFPT—7, pp 138-146) **Comparison of FEMAXI-III code calculations with irradiation experiments.** Ito, K.; Sogame, M. (Nippon Nuclear Fuel Development Co. Ltd., Ibaraki-Gun, Japan); Ichikawa, M.; Nakajima, T. (Japan Atomic Energy Research Institute); Okubo, T. (Sophia Univ., Tokyo, Japan); Saito, H. (Century Research Center Co. Ltd., Japan). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

The FEMAXI-III code calculations were compared with in-pile diameter measurements in the HBWR, in order to check the ability to analyze the pellet-cladding mechanical interaction. The results showed generally good agreement between calculations and measurements. The Studsvik INTER-RAMP Experiments were also analyzed to examine the predictability of fuel rod failures. Good agreement was given between calculated and measured fission gas release. The threshold stress to cause failure was estimated by means of FEMAXI-III.

480 (IWGFPT—7, pp 147-159) **Development of program FREC: theory and models.** Harayama, Y.; Izumi, F.; Uchida, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A program FREC (Fuel Realiability Evaluation Code) is being developed which predicts a fuel rod performance under normal reactor operation. Emphasis is placed on predicting the cladding elongation for full length of the fuel rod induced by PCMI, including influence of a part (a rigid collar or a preloaded spring) inserted in fuel rod lower plenum. A fuel rod is divided into axial segments. In each segment, it is assumed that temperature, stresses and strains are axially symmetrical, and axial strain conditions are independent for fuel pellets and the cladding. Applying a method developed in CYGRO to a segment, FREC obtains stiffness matrices between contact load rates and gap clearance rates. Then using them as element matrices, FREC forms a global stiffness equation of the fuel rod including upper and lower plenum. Contact loads and gap clearances along the fuel rod length are obtained by solving the global stiffness equation. The method adopted in FREC is proved to be simple and suited for predicting the fuel rod deformations over full length.

481 (IWGFPT—7, pp 190-195) **Implications of recent developments in the plastic fracture mechanics field to the PCI stress corrosion problem.** Smith, E. (Manchester Univ. (UK). Dept. of Metallurgy). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

Fractographic observations on Zircaloy cladding stress corrosion fracture surfaces are considered against the background of recent developments in the plastic fracture mechanics field. Dimples have been observed on the fracture surfaces of failed cladding, even though the cracks in metallographic sections are tight, i.e., crack propagation is associated with a low crack tip opening angle. This result is interpreted as providing evidence for an environmentally assisted ductile mode of fracture. The presence of this fracture mode forms the basis of an argument, which adds further support for the view that power ramp stress corrosion cladding failures are caused by stress concentrations that produce stress gradients in the cladding.

482 (IWGFPT—7, pp 196-210) **Comparison of grain growth measurements and predictions for fuel rods S176-6, -7, -8, and -9.** Malen, K. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

The aim of the S176 series of irradiation experiments is to obtain basic data on the migration of fission products in intact fuel rods. In order to use the information on the radial distribution of fission products it is important to know the local temperatures. In this paper grain growth predictions using our present modification of GAPCON-THERMAL-2 are compared to the radial grain size distributions measured. Measurements have been performed at three axial positions for each rod. For fuel rods S176-6, -8 and -9 the grain growth determining final irradiation was for 53, 100, and 106 hours, respectively. The axial power profile was determined from gamma scanning and samples were taken at the mid positions with the power of about 47 kW/m and at upper and lower end positions with powers in the range 35 to 40 kW/m. We have not succeeded in making correct predictions for both the grain growth at the maximum power position and at the positions with lower power simultaneously. Correct grain growth at the maximum power position leads to too small grain growth at the lower power positions.

483 (IWGFPT—7, pp 216-227) **FEMAXI-III: an axisymmetric finite element computer code for the analysis of fuel rod performance.** Ichikawa, M.; Nakajima, T. (Japan Atomic Energy Research Inst.); Okubo, T. (Sophia Univ., Tokyo, Japan); Iwano, Y.; Ito, K. (Nippon Nuclear Fuel Development Co. Ltd, Ibaraki-Gun, Japan); Kashima, K. (Central Research Institute of Electric Power Industries, Japan); Saito, H. (Century Research Center Co. Ltd, Japan). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

For the analysis of local deformation of fuel rods, which is closely related to PCI failure in LWR, FEMAXI-III has been de-

veloped as an improved version based on the essential models of FEMAXI-II, MIPAC, and FEAST codes. The major features of FEMAXI-III are as follows: elasto-plasticity, creep, pellet cracking, relocation, densification, hot pressing, swelling, fission gas release, and their interrelated effects are considered. Contact conditions between pellet and cladding are exactly treated, where sliding or sticking is defined by iterations. Special emphasis is placed on creep and pellet cracking. In the former, an implicit algorithm is applied to improve numerical stability. In the latter, the pellet is assumed to be non-tension material. The recovery of pellet stiffness under compression is related to initial relocation. Quadratic isoparametric elements are used. The skyline method is applied to solve linear stiffness equation to reduce required core memories. The basic performance of the code has been proven to be satisfactory.

484 (IWGFPT—7, pp 228-235) **In-reactor densification and relocation of $UO_2$ pellet fuel: preliminary results from the Springfields programme.** Ainscough, J.B.; Moore, D.A.; Lang, C. (UKAEA Springfields Nuclear Power Development Labs.); Clough, D.J. (UKAEA Atomic Energy Research Establishment, Harwell). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A series of instrumented single pin irradiations is being carried out in the High Pressure Water Loop of the DIDO reactor at Harwell to investigate the temperature changes which occur in $UO_2$ pellet fuel during the early stages of irradiation up to about 2600 MWd/teU burn up. Fuel center temperatures have been deliberately kept low so that fission gas release and its attendant effects on fuel temperatures are minimized. As a result, the observed temperature changes can be ascribed solely to densification, relocation of the fuel or small relative movements of fuel and cladding. While no special power cycling programme was used in the tests, the normal reactor shut-downs together with unscheduled reactor trips were sufficient to provide clear evidence of the effect of relocation on fuel temperature. Results obtained in two of these irradiations are presented and compared. The fuel density in both was 10.6 te/$m^3$ but in one the porosity was predominantly unstable while in the other the desired voidage had been obtained by incorporating a pore former into $UO_2$ with a high (approximately 10.8 te/$m^3$) matrix density. The observed changes in pellet bore temperature in the first irradiation are converted into changes in the effective fuel/cladding gap width and hence to density changes. A preliminary comparison is also made with the results of fuel pin performance modelling calculations of densification. The performance code does not at present model relocation and in consequence over-predicts fuel temperatures after the first major power cycle. In the second irradiation fuel and clad were probably in contact, at least at pellet ends, throughout the irradiation and the temperature changes which occur, and which in general are not well modelled in the computer code, are attributed to small relative movements of fuel and cladding.

485 (IWGFPT—7, pp 244-251) **Probabilistic evaluation of fuel element performance by the combined use of a fast running simplistic and a detailed deterministic fuel performance code.** Misfeldt, I. (Risoe National Lab., Roskilde (Denmark)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A comprehensive evaluation of fuel element performance requires a probabilistic fuel code supported by a well bench-marked deterministic code. This paper presents an analysis of a SGHWR ramp experiment, where the probabilistic fuel code FRP is utilized in combination with the deterministic fuel models FFRS and SLEUTH/SEER. The statistical methods employed in FRP are Monte Carlo simulation or a low-order Taylor approximation. The fast-running simplistic fuel code FFRS is used for the deterministic simulations, whereas simulations with SLEUTH/SEER are used to verify the predictions of FFRS. The ramp test was performed with a SGHWR fuel element, where 9 of the 36 fuel pins failed. There seemed to be good agreement between the deterministic simulations and the experiment, but the statistical evaluation shows that the uncertainty on the important performance parameters is too large for this nice result. The analysis does therefore indicate a discrepancy between the experiment and the deterministic code predictions. Possible explanations for this disagreement are discussed.

486 (IWGFPT—7, pp 252-259) **Progress with the probabilistic fuel failure code POSHO.** Rolstad, E.; Sauar, T.O. (Scandpower A/S, Halden, Norway). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

POSHO was developed upon request from Utility personnel, who were frustrated by the situation that fuel failures were so obviously occurring due to sudden power increases (power shocks), but no calculational tools existed, capable of predicting the failures and for guiding the operators on how to avoid them. A qualitative understanding of the problem gradually developed among utilities, and operators modified their operating procedures accordingly. The POSHO Code, which specifically relates the power shock received during power ramps to the probability for PCI-failures, provides a unique tool in PCI-related operations guidance. Compared to the operating recommendations in use today, POSHO presents several features which are not found in these rules: POSHO provides a continuous model for the severity of the interaction status, with respect to probability for PCI failures. It is thus possible to take into account the specific situation which exists for the fuel during a given power maneuver; the statistical failure probability concept in POSHO enables the assessment of the total effect resulting from a large number of local PCI events; by a systematic application of POSHO, it is possible to speed up the learning process with respect to determining the actual limits for a given fuel.

487 (IWGFPT—7, pp 267-276) **Ballooning of cladding tubes.** Matthews, J.R. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.); Tripp, R.N. (Bath Univ. (UK)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

Previous descriptions of clad ballooning have only considered radial displacements and neglected bending moments. In this paper the problem is formulated to include all three components of displacement and bending. It is found that for non-linear creep deformation bending moments may be neglected for most cases, but tangential displacements are more important than radial displacements for the non-uniform components of deformation. This has been found to lead to three important conclusions: (1) the cladding tends to retain its cylindrical cross section when subjected to circumferential variations in temperature, (2) higher harmonics of circumferential deformation are significant until limited by bending, typically for harmonics greater than around the 20th. This is contrary to a strong restriction on the growth of harmonics greater than the 1st found when only radial displacements are permitted. (3) Cladding tends not to bulge away at hot spots but thins locally. This can lead to reduced ductility in fuel cluster conditions. The effect of anisotropy is briefly discussed.

488 (IWGFPT—7, pp 276-282) **Effects of uncertainties of experimental data in the benchmarking of a computer code.** de Meulemeester, E.; Bouffioux, P.; Demeester, J. (Societe Belge pour l'Industrie Nucleaire, Brussels). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

Fuel rod performance modelling is sometimes taken in an academical way. The experience of the COMETHE code development since 1967 has clearly shown that benchmarking was the most important part of modelling development. Unfortunately, it requires well characterized data. Although, the two examples presented here were not intended for benchmarking, as the COMETHE calculations were only performed for an interpretation of the results, they illustrate the effects of a lack of fuel characterization and of the power history uncertainties.

489 (IWGFPT—8, pp 64-70) **Use of probabilistic fuel performance codes in the planning and evaluation of irradiation experiments.** Misfeldt, I. (Helsingoer Vaerft A/S, Denmark). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

As well in the planning as in the evaluation of fuel experiments it is important to know the influence on the test results from

the uncertainties (tolerances) of design parameters, material properties, and test specifications. This information can be obtained by a probabilistic fuel performance code like FRP. A fuel performance code simulates detailed processes which take place during the irradiation, and therefore the use of a code requires detailed information on the fuel and the irradiation. The present paper details these requirements and discusses the influence on the expected fuel performance from the most important specifications required. Examples are given on the evaluation of performed ramp tests, especially with regard to the expected uncertainties on the test results.

490 (IWGFPT—8, pp 112-120) **Power ramp performance of vipac fuel.** Knudsen, P.; Bagger, C.; Carlsen, H. (Risoe National Lab., Roskilde (Denmark)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

Vibrationally compacted powder fuel (vipac) may conceivably perform better than sintered pellet fuel in power ramp situations, because the smaller fuel particles may give less stress concentrations in the cladding at hard fuel-clad contact. It is, therefore, of interest to examine experimentally the power ramp performance of vipac fuel. Four Zircaloy-clad vipac pins and one pellet pin were ramp tested at a burnup of 17,900 MWD/t$UO_2$. Three of the vipac pins failed in fast ramps at peak heat loads of 411 to 459 W/cm and the pellet pin failed at 348 W/cm. The fourth vipac pin was conditioned at 379 W/cm for 2 days; with a slow ramp rate of 5 W/cm.min, an overpower level of 528 W/cm was reached without failure indication. An evaluation of the local overpower levels and the eddy-current observations showed that the vipac pins had an advantage of about 80 W/cm over the pellet pin in terms of minimum heat load required for interaction and defection. The many cladding cracks seen in one of the failed vipac pins had the usual brittle appearance attributed to stress-corrosion cracking.

491 (IWGFPT—8, pp 121-127) **Experimental observations of the PCI failure occurrence on power ramping.** Bergenlid, U.; Mogard, H.; Roennberg, G. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

On performing various over-power ramp experiments in the R2 test reactor at Studsvik, Sweden, observations of certain phenomena associated with the PCI/SCC failure occurence have been made. These observations concern primarily the occasional appearance of so-called power spikes, the response of the rod elongation detector to the failure event, and to some extent the formation of incipient cracks on the inside surface of the Zircaloy cladding. Failure of the cladding of a fuel rod during a ramp test is usually indicated by the release of activity to the cooling water. The moment of the crack penetration is more accurately determined by the observation of a power spike and probably also by a contraction of the cladding tube.

492 (IWGFPT—8, pp 160-169) **Stress corrosion testing of irradiated Zircaloy cladding and its relevance to PCI failure.** Lunde, L.; Videm, K.; Aas, S. (Institutt for Energiteknikk, Kjeller (Norway)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The environmental variables in the SCC test have larger influence on the lifetime for autoclaved material than for pickled and sandblasted metal. The effect is even more pronounced for irradiated and oxidized material as a ten times increase in the iodine concentration reduced the failure stress from 500 to 250 MPa. As neither the environment inside of the fuel rods is known, nor its stress corrosivity, it is a difficult task to design SCC testing conditions which give data applicable with respect to PCI failure predictions for fuel rods. Some views are discussed. By comparing our results with published data it is concluded that the failure stress (after 1 to 3 hours) is very dependent upon the neutron dose. Neutron damage will raise the stress threshold for doses up to $10^{20}$ n/cm$^2$ and thereafter the failure stress is gradually decreased to low values with increasing neutron doses up to $5.10^{21}$ n/cm$^2$.

493 (IWGFPT—8, pp 200-203) **Failure boundary for stress corrosion cracking based on fuel temperature and cladding load. A new approach to improving fuel reliability.** Hollowell, T.E. (Institutt for Energiteknikk, Halden (Norway). OECD Halden Reaktor Prosjekt). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

A study of a large base of experimental and operational data on stress corrosion cracking has shown that many design and operating parameters contribute simultaneously to determining the occurrence of SCC failures. Nearly all of the important parameters, however, derive from or effect two primary parameters, namely fuel temperature and cladding stress or strain. An evaluation and plotting of the fuel temperature and cladding strain during 310 power ramp events has shown that a clear boundary exists which separates failures from non-failures in the fuel temperature-cladding strain space. A fast running calculational model called PREFAIL (for PRE vent FAIL ure) has been developed to calculate the fuel temperatures and cladding strains. The correlations utilized in the calculations are based on a direct statistical correlation of large amounts of data generated at the OECD Halden Reactor Project. The model includes the most important parameters affecting fuel temperature and cladding strain including pellet-cladding gap, densification, temperature dependent swelling, burnup, cladding creepdown, and cladding thickness. Other effects which are treated inherently by the location of the failure boundary are fission product release and fuel creep/plasticity. It is believed this type of failure model provides a good compromise between detailed mechanistic models, which require extensive inputs and long running times, and solely empirical models which consider too few parameters (i.e., power and burn-up only).

494 (IWGFPT—8, pp 226-239) **Threshold values characterizing iodine-induced SCC of Zircaloys.** Une, K. (Nippon Nuclear Fuel Development Co. Ltd, Higashi-ibaraki-gun, Japan). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

In this paper, threshold values of stress, stress intensity factor, strain, strain rate and iodine concentration for SCC of unirradiated and irradiated Zircaloys are reviewed. The ratio of $\sigma$/sub th//$\sigma$/sub y/ adequately represents the effects of cold-work and irradiation on the SCC susceptibility, where threshold stress $\sigma$/sub th/ is defined as the minimum stress to cause SCC to failure after 10 to 20 hours and $\sigma$/sub y/, the yield stress obtained in an inert atmosphere. The ratio becomes gradually smaller with larger $\sigma$/sub y/ and is less than 1 for materials with yield strengths above about 350 MPa. Plastic strain appears to be necessary for SCC; plastic strains to failure range from 0.1 to 1% for high strength materials, even when data for irradiated materials are included. Strain rate significantly affects the susceptibility. A comparison of SCC data between constant strain rate and constant stress tests is presented.

495 (IWGFPT—8, pp 239-255) **Stress corrosion cracking of Zircaloy. The use of laboratory data to predict in-reactor behaviour.** Miller, A.K.; Ocken, H. (Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

Pellet-cladding interaction (PCI) can lead to failure of the Zircaloy tubing used as cladding in water-cooled reactors. Many investigations have shown that the mechanism directly responsible for such fuel rod failures is stress corrosion cracking (SCC) of Zircaloy tubing. Laboratory studies have yielded extensive data on the time-to-failure (t/sub f/) behavior of Zircaloy tubing specimens as a function of such important variables as the applied hoop stress ($\sigma$/sub h/), the iodine concentration ($I_2$), the temperature (T) and the fluence (F). These data have been used to predict the response of Zircaloy tubing exposed in-reactor. A typical approach is to fit laboratory data to obtain an empirical equation for t/sub f/ in terms of the variables identified above. The question can then be posed as to whether it is appropriate to use such an empirical expression for predicting in-reactor behaviour. This paper describes the approach which has been taken in modelling the SCC process. It first reviews the experimental observations upon which the model is based. A

summary of the key features of the model is then presented. The model's capabilities, emphasizing those predictions that are independent of data used to evaluate empirical constants, are briefly discussed. Finally, it is shown how the model can be used to predict important differences between the response of tubing specimens exposed in the laboratory and the response of large quantities of tubing exposed in-reactor.

496 (IWGFPT—8, pp 287-294) **PCMI modelling in COMETHE.** Hoppe, N. (Societe Belge pour l'Industrie Nucleaire, Brussels). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The mechanisms which are important in PCI are reviewed, as modelled in COMETHE, including the latest improvements. They include fuel swelling and plasticity, tunneling in fission gas release, clad creep down, fuel-clad interaction, local effects and s.c.c. models. Fabrication parameters are important both for fuel and clad. Failure predictions require the whole set of these models, particularly the ridging model; the prediction of time to failure and the selection of a failure model require accurate data, both on material characteristics and power duty, as inputs, and on experimental irradiation behavior, as benchmarking basis.

497 (IWGFPT—8, pp 31-33) **Inpile irradiations for verification of pellet clad interaction predictions.** Anand, A.K.; Anantharaman, K.; Basu, S.; Mehta, S.K. (Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

Performance of the COMTA computer program developed for predicting pellet-clad interactions was experimentally evaluated on well characterized fuel rods in pressurized water loop, located in the CIRUS research reactor at Bhabha Atomic Research Centre. Experimental data obtained in $5 \times 10^{13}$ n/cm$^2$ neutron flux post-irradiation examination of $UO_2$, $UO_2$-$PuO_2$ pellets, and Zircaloy tubing was used for comparison.

498 (IWGFPT—8, pp 34-40) **Experimental strategy of fuel performance testing with respect to PCI.** Vogl, W.; von Jan, R.; Stehle, H. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The concept and results of the experimental strategy of fuel performance testing developed by KWU and based on the RSST approach are presented. RSST means the evaluation of a defect-free power Range below a PCI defect threshold and a defect-free LHGR Step, a limited Speed of power increase if both limits are exceeded, and a minimum Time for any mechanism to become effective.

499 (IWGFPT—8, pp 57-64) **Statistical trends observed in published data of PCI failures.** Bairiot, H.; Haas, D. (Societe Belge pour l'Industrie Nucleaire, Brussels). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The INEL data base, as presented by EG and G at the October 1978 ANS/ENS international meeting on nuclear power reactor safety, presents graphically the effect of some single parameters on the failure probability of the tested fuel rods. It includes the pellet density, the cladding thickness, the fuel-cladding gap, the ramp rate, the terminal power, and the fuel burn-up. Although it is recognized that failure cannot be ascribed to one single parameter, the observed probability curves can be explained and are generally in agreement with the experience we have accumulated in dealing with BWR and PWR fuels.

500 (IWGFPT—8, pp 92-103) **Performance of mixed oxide fuel at high burnup and comparison with $UO_2$ fuel.** Haas, D.; Lippens, M.; Thomson, J.M. (Societe Belge pour l'Industrie Nucleaire, Brussels). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

A survey of post-irradiation examinations carried out on a series of Zircaloy clad $UO_2$ and mixed oxide rods irradiated in the BR 3 PWR and in the DODEWAARD BWR has shown that the strongest pellet-cladding interaction occurs in $UO_2$ rods. This is demonstrated by the large pellet ridging, the lower creep-down effect and by the absence of cladding ovalization, as well as by the larger axial rod elongation in the $UO_2$ rods. The higher PCI in case of $UO_2$ fuel is explained by both the lower fuel swelling accommodation of this $UO_2$ fuel and the lower creep strength of the powder agglomeration mixed oxide fuel. Fission gas release is shown to be larger in mixed oxide fuel and strongly enhanced in absence of pellet-cladding mechanical interaction. Cesium uranates deposits on the cladding, at the level of the pellet interfaces are usually observed in high fission gas release rods.

501 (IWGFPT—8, pp 149-159) **Analysis of PCI by FEMAXI-III.** Ichikawa, M.; Nakajima, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Kinoshita, M. (Central Research Inst. of Electric Power Industries, Japan); Ito, K.; Kogai, K. (Nippon Nuclear Fuel Development Co. Ltd, Japan); Saito, H. (Central Research Center Co. Ltd, Japan); Okubo, T. (Sofia Univ. (Bulgaria)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

FEMAXI-III has been developed for the analysis of PCI with special emphasis on local deformation calculations based on finite element method. Elastoplasticity, creep, pellet cracking, relocation, densification, hot pressing, swelling, fission gas release, and pellet-cladding contact problems are considered in the programme. The results of calculation for fuel centerline temperature and cladding deformations have been compared with the in-pile experiments in HBWR with good agreement. The code was applied to the Studsvik Inter Ramp Project experiments for better understanding of the results. Calculated deformation and fission gas release were in good agreement with measurement and a failure criterion is proposed based on stress and fission gas calculations of FEMAXI-III.

502 (IWGFPT—8, pp 78-85) **Experience and plans with PCI protection in KWU LWR plants.** von Jan, R.; Hering, W. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

The experience with early operational guidelines to eliminate PCI failures is briefly discussed. For future applications a more detailed PCI surveillance and protection model is proposed. It is designed for the use in administrative guidelines as well as in automatic power density surveillance and limitation systems. Important model parameters are directly derivable from experimental data by using the RSST Approach that - in order to prevent PCI failures - at least one out of four predictors (i.e., power range, power step, speed of power increase, or time at transient overpower) has to be below a critical value at any operating time. An algorithm is provided for defining and monitoring an adequate conditioned power as a reference power for acceptable power ramps beyond the PCI failure threshold. The operational consequences of the new surveillance model are reviewed and it is shown, that expected power losses are similar or less than from early guidelines. Finally, relevant features of mechanistic PCI fuel rod models are discussed. Some of the PCI failure prediction models, which have been proposed in the literature, seem to be unnecessarily conservative and - if strictly applied to LWR core surveillance - lead to unduely severe restrictions in plant operation.

503 (IWGFPT—8, pp 170-181) **Experiments to settle an ISCC hypothesis for Zry-tubing.** Peehs, M.; Jung, W.; Stehle, H.; Steinberg, E. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

In evaluating the experimental data on ISCC of Zircaloy tubing three steps may be postulated: a chemical formation step, a crack initiation step, and a crack propagation step. The chemical formation step was analyzed by the investigation of I/Zr-reactions under unstrained conditions. The I/Zr ratio of the zirconium iodide deposit, which is formed on the surface, increases up to 4 ($ZrI_4$)

depending on time. The crack initiation step occurs rather simultaneously with the chemical formation step under strained conditions. The statistical distribution of the crack length can be described by a logarithmic normal distribution. In the crack propagation step at least two mechanisms are responsible for crack growth: growing of each individual crack and interconnection of cracks which are aligned or nearly aligned. Thus, the number of cracks decreases with time, but the type of the statistical distribution was found to be unchanged. Evaluation of the shape of the cracks showed that the ratio of depth to length is always about 1:4. In a mechanistic model the chemical aspect is to be based on the availability of $ZrI_4$ in the gas phase evaporating from the ZrI/sub x/ deposits on the Zry surface. $ZrI_4$ undergoes a disproportion reaction at the crack tip consuming Zr and forming a less volatile compound.

504 (IWGFPT—8, pp 255-287) **Mechanistic considerations pertinent to the PCI fuel failure phenomenon.** Pankaskie, P.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

A fuel Pellet-Zircaloy Cladding (thermo-mechanical-chemical) Interactions (PCI) failure model for estimating the probability of failure in transient increases in power (PROFIT) was developed. PROFIT is based on (1) standard statistical methods applied to available PCI fuel failure data, and (2) a mechanistic analysis of the environmental and strain-rate-dependent stress versus strain characteristics of Zircaloy cladding. The statistical analysis of fuel failures attributable to PCI suggested that parameters in addition to power, transient increase in power, and burnup are needed to define PCI fuel failures in terms of probability estimates with known confidence limits. The PROFIT model, therefore, introduces an environmental-and strain-rate dependent strain energy absorption to failure (SEAF) concept to account for the stress versus strain anomalies attributable to interstitial-dislocation interaction effects in the Zircaloy cladding. Assuming that the power ramping rate is the operating corollary of strain-rate in the Zircaloy cladding, then the variables of first order importance in the PCI fuel failure phenomenon are postulated to be: (1) pre-transient fuel rod power, P/sub i/; (2) transient increase in fuel rod power, ΔP; (3) fuel burnup, Bu, and (4) the constitutive material property of the Zircaloy cladding, SEAF.

505 (IWGFPT—8, pp 103-111) **PCI performance of $PuO_2$-$UO_2$ fuels irradiated in water reactors.** Kaneko, H.; Nakae, N.; Tachibana, T.; Honda, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

A number of irradiation programs were carried out on $PuO_2$-$UO_2$ fuels for Fugen and thermal reactors using various reactors such as HBWR, SGHWR, GETR, SAXTON and JRR-2. The results show that irradiation conditions were not in the area where PCI performance becomes serious, and the $PuO_2$-$UO_2$ fuels exhibited no apparent difference compared with $UO_2$ fuels. An instrumented irradiation of $PuO_2$-$UO_2$ fuel rods in HBWR shows some interesting thermal and mechanical behaviors. During a power down of the second cycle, fuel rods experienced two steps of short time power holdings. At first power holding, claddings exhibited quick elongation although they experienced elongation and relaxation at maximum power of the cycle. The elongation was finally relaxed during the second power holding. This phenomena happened on all of three fuel rods with cladding extensometer. This is because all fuel rods had nearly the same pellet cladding gap width. The reason of the phenomena may be explained that pellets keep slip contact with clad even after relaxation of PCMI at maximum power, they can be locked up by a slight power up during the power holding where the power could not be kept strictly constant. A quasi-one dimensional fuel pin performance code CEDAR-TH was developed to evaluate a performance of thermal reactor fuels. A finite element PLASTIC code was also developed to calculate stress concentration on cladding by pellet cracking in r-theta two-dimensional geometry.

506 **Equipment for mechanical piercing and free volume determination.** Carlsen, H. (Risoe National Lab., Roskilde (Denmark)). pp 342 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

507 **In-cell refabrication of experimental fuel rods using rods pre-irradiated in a power reactor.** Vignesoult, N.; Atabek, R.; Ducas, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service des Elements Combustibles et Structures). pp 207-212 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The C.E.A. has long been concerned by the study of interaction between the fuel and its cladding; for this purpose, short rods are rebuilt in hot cells from long power reactor rods. This reassembly in hot cell, needs special equipment and particular attention in order to preserve the essential characteristics of the initial rod. This technique is very interesting in the sense that: it avoids long and expensive irradiation in experimental reactors; it allows reirradiation of fuel from existing power reactors; and it is possible to test several short rods, made from the same long rod and therefore with the same characteristics. In this paper, the following points will be developed: the various steps of the 'FABRICE' rod reassembly in hot cells, with attention focused on the particular care to avoid any risk of pollution and modification of the initial rod characteristics; the description of the equipment and the various quality insurance test testings; and the first results of the qualifying program of the 'FABRICE' operation.

508 **Eddy-current testing as a tool for post-irradiation examination.** Francke, K.P.; Manzel, R.; Rutsch, F.; Vogt, E. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 55-59 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Eddy-current testing is a standard technique used by KWU for post-irradiation examination (PIE) in the spent fuel pool as well as in the Hot Cells. An encircling coil is used for the detection of imperfections and defects in the cladding material of LWR fuel rods and other core components. A newly developed eddy-current probe technique is used for the determination of oxide layer thickness on LWR fuel rods and flow channels. Both systems are described and the results obtained are presented.

509 **Post-irradiation chemical analysis of irradiated nuclear fuels.** Foster, E. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). pp 349 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

510 **Post-irradiation examination of light water reactor fuel. A United States perspective.** Neimark, L.A. (Argonne National Lab., IL (USA)); Ocken, H. (Electric Power Research Inst., Palo Alto, CA (USA)). pp 13-18 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Poolside and hot-cell postirradiation examination (PIE) have played and will continue to play a significant role in the U.S. LWR program. The principal uses of PIE are in fuel surveillance, fuel improvement, and failure analysis programs and in the postmortem analysis of safety-related tests. Institutional problems associated

with fuel shipping, waste disposal, and fuel disposal can be expected to pose obstacles to hot-cell examinations and likely result in more sophisticated poolside examinations.

511 **Review and comments about gamma scanning analysis on PWR and FBR fuel elements.** Pineira, T.; Mouchnino, M.; Jeste, G.; Vignesoult, N. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). pp 67-74 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The $\gamma$ scanning analysis on PWR and FBR reactor fuel elements has acquired an important development in the CEA. In order to take full advantage of the method, it has to acquire a high degree of automation and the interpretation of results must be the work of a coherent team of $\gamma$ spectrometry and fuel element specialists. The development of $\gamma$ spectrometry in hot laboratory requires the processing of an important number of data, from which the quality of results depends. Consequently, the necessity to get the maximum of information and especially to present the results under an easily workable form, in a short time, requires a highly automatized system. Moreover, the most specific $\gamma$ scanning results linked to metallurgical results obtained in the laboratories must efficiently lead to obtain the major information. The following points are emphasized: the quantitative and non destructive aspect of the measurements, which permit to reach very quickly the main neutronic parameters (ex: burn-up); the study of the axial and radial repartition of cesium in fuel pins for fast reactors; and the study of the radial migration of cesium in PWR elements irradiated in transient conditions with pellet-cladding interaction and cladding corrosion.

512 **Further developments in the non-destructive examination of irradiated fuel rods at Windscale.** Cross, M.T.; Goldsmith, L.A.; McKee, F.; Sumerling, R. (UKAEA Windscale Nuclear Power Development Labs.). pp 61-66 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Useful experience has now been gained with the modular NDE system for water-reactor and AGR-type fuel rods. The system uses a fully-automatic fuel rod drive machine which is designed for easy maintenance and is fitted with interchangeable modules for eddy-current testing, non-contact diameter measurements and leak location. Further modules (eg an oxide thickness gauge) are currently undergoing trials. The fuel rod can also be gamma-scanned and viewed optically or by TV as these other tests are taking place. Increasing use is now being made of dual frequency eddy-current testing, particularly for AGR fuel rods, and there appears to be considerable scope for increasing sensitivity to defects using this system.

513 **Experience gained in the accurate measurement of fission product distributions by axial fuel pin gamma scanning.** Dawson, J.T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Smith, G. (UKAEA Atomic Energy Establishment, Winfrith). pp 325 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

514 **Application of the linear accelerator to radiographic inspection of irradiated fuel elements.** Matsushima, H.; Kashihara, H.; Kobayashi, S. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). pp 43-48 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

A radiographic technique using the linear accelerator has been developed and applied to the inspection of irradiated fast-reactor core elements. This accelerator, emitting X-rays with high dose rates, has proved to be an excellent source for radiography. Gamma-ray fogging and scattered X-ray exposure from irradiated specimens have been reduced by using a shutter and grid device. This equipment has been used for radiography on different types of irradiated core elements up to $6 \times 10^4$ Ci of activity. The results show that the system was designed successfully and this accelerator is useful for radiographic inspection.

515 **Examination of fuel rods by means of neutron radiography.** Bergenlid, U.; Gustafsson, I. (Studsvik Energiteknik AB, Nykoeping (Sweden)). pp 49-53 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The equipment used for examination of fuel rods by means of neutron radiography at the Studsvik R2 reactor is described. This is followed by a review of the information obtainable from the radiographs. Pellet diameters are determined by means of a microdensitometric method which is described together with some results.

516 **Examination of heavily defected fuel-pin bundles.** Geithoff, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). pp 123-128 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Fuel pin bundles with severe damage require a different approach when it comes to postirradiation examination. The usual way of dismantling the bundle and looking after the single pins proved to be inadequate for the study of the 18 pin bundle Mol-7B. Phenomena like pin to pin failure propagation and coolant blockage were difficult to assess from the findings in post-irradiation-examination. In the new approach the complete pin bundle is treated as an individual to the last step, ceramography. By this way two bundles Mol-7C/1 and -7C/2 have been examined so far. In the course of the work special emphasis has been placed on nondestructive examinations such as neutron-radiography, betatron-radiography, and $\gamma$-scanning. Ceramography of transverse sections with 30 fuel pins in place was successful in as much as the same surface quality was obtained as with single pins. By a simple procedure the defected pins could be easily distinguished from their intact neighbours.

517 **Comparison between alpha autoradiography and some measured alpha emitting actinide profiles in a (UPu)C sphere-pac fuel.** Flueckiger, U. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). pp 332 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

518 **Aspects of large scale production of $UO_2$ pellets.** Kondal Rao, N. (Nuclear Fuel Complex, Hyderabad (India)). pp 165-169 of Proceedings of the symposium on sintering and sintered products [held at] Bombay, October 29-31, 1979. Bombay, India; Department of Atomic Energy (1980).

From Symposium on sintering and sintered products; Bombay, India (29 Oct 1979).

The production of ceramic grade uranium dioxide powder and uranium dioxide sintered pellets at Nuclear Fuel Complex, Hyderabad is described. The major problems that were encountered during the production of tonnage quantities of uranium oxide are detailed. The efforts that were put at the R and D stage and for bringing into commercial production, the equipment needed for the powder compaction and sintering are also detailed. Special high

temperature refractories and other consumables that were required to withstand the severity of temperatures required for $UO_2$ sintering are also mentioned, specially those which were developed in collaboration with the private industry. Today with the efforts put in by Nuclear Fuel Complex, refractory materials of any shape that can withstand upto 1700degC are available in the country. The continuous multizone sintering furnaces can also be indigenously made within the department which were hitherto imported to meet the country's needs.

519 **Effect of precompaction on sintered $UO_2$ pellets.** Rajagopalan, P.P.; Ramachandran, R.; Mehrotra, R.S. (Bhabha Atomic Research Centre, Bombay (India). Radiometallurgy Section). pp 375-386 of Proceedings of the symposium on sintering and sintered products [held at] Bombay, October 29-31, 1979. Bombay, India; Department of Atomic Energy (1980).

From Symposium on sintering and sintered products; Bombay, India (29 Oct 1979).

In powder metallurgy fabrication technique, precompaction and granulation of powders is done to improve powder flowability, to decrease the die fill length, etc. A study has been carried out in Radiometallurgy Division of B.A.R.C. to evaluate the effect of precompaction pressure on the characteristics of sintered $UO_2$ pellets. The precompaction pressure has been varied from 0-20 Tsi with the final compaction pressure being maintained at 15 Tsi and 20 Tsi. As the ratio of precompaction pressure to final compaction pressure is increased, the pore size in the sintered pellet increases and the proportion of open porosity in the sintered pellet increases, though the sintered density improves marginally.

520 **Steady state behaviour of gaseous fission products in $UO_2$ nuclear fuel at low temperature.** Rao, C.B.; Raj, B. (Reactor Research Centre, Kalpakkam (India)). pp 387-400 of Proceedings of the symposium on sintering and sintered products [held at] Bombay, October 29-31, 1979. Bombay, India; Department of Atomic Energy (1980).

From Symposium on sintering and sintered products; Bombay, India (29 Oct 1979).

Theoretical modelling studies have been performed on steady state fission gas behaviour in $UO_2$ fuels at temperatures in the range 1073deg K to 1473deg K. The concentrations of gas atoms in the matrix and in the bubbles are determined. Fraction of total generated gas atoms migrating to and forming bubbles at grain boundaries is calculated. Contributions of intragranular and intergranular bubbles to the swelling are also computed. The various assumptions made to simplify computer calculations and their validity are discussed at length. Effects of changes in the fission rate, the resolution parameter, bubble concentration, gas atom diffusivity and grain radius on swelling and gas release are studied. The results of this model are compared to other theoretical models and experimental results available in literature. Possibility of extending the present model to advanced carbide and nitride fuels is discussed.

521 **Factors affecting the sintered density of plutonium oxide.** Ramachandran, R. (Bhabha Atomic Research Centre, Bombay (India). Radiometallurgy Section). pp 455-471 of Proceedings of the symposium on sintering and sintered products [held at] Bombay, October 29-31, 1979. Bombay, India; Department of Atomic Energy (1980).

From Symposium on sintering and sintered products; Bombay, India (29 Oct 1979).

Sintering studies were carried out on $PuO_2$ powders. The major factors affecting their sintered densities were identified. $PuO_2$ prepared from plutonium oxalate was used in this work. Experiments with powders obtained by calcining at temperatures from 350deg C to 800deg C indicated that calcination at 600deg C was best suited for compaction and sintering and densities of 90% TD could be obtained by sintering at 1450deg C in A + 6% $H_2$ atmosphere. Increase in compaction pressures improved the sintered densities of compacts from powders of lower temperature of calcination. There was a decrease in density when the sintering temperature was increased from 1550deg C to 1650deg C and 30 to 40% of cubic PuOsub(1.52) was present in the sintered pellets. Oxidising atmosphere was found to be beneficial in general for getting higher densities. Excess moisture in sintering atmosphere and powder storage for long periods adversely affected sinterability.

522 **Prediction of creep transients in Zircaloy fuel cladding using anelastic strain model.** Murty, K.L.; Yoon, K.K. (Babcock and Wilcox Co., Lynchburg, VA (USA). Lynchburg Research Center). pp C3/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Nuclear fuel cladding tubes are subject, in service, to complex multiaxial loading that might undergo sudden changes. An accurate description of the strain response due to this transient behavior is essential in reliably predicting the accumulated plastic strains in the cladding. Direct extrapolations of the creep behavior under constant load to describe creep under varying loads result in significantly larger strains than observed, mainly due to the negative (inverse) transients following load drops. The model equations developed in the past by Murty, et al., were based on the climb-controlled dislocation slip and were shown to successfully predict the creep behavior of Zircaloy cladding under a given set of constant loading conditions. Variations in any of the test variables, especially stress during a creep test produce 'transients' following the sudden change; in particular, negative creep (contraction) results following a significant drop in the applied stress. These creep equations in their present form cannot account for this transient behavior.

## 2204 Control Systems

*REFER ALSO TO CITATION(S) 274, 871*

523 (AECL—7056, pp 9-19) **Requirements and concepts for a nuclear plant surveillance and diagnostic system (NPSDS).** Nicholson, P.J. (Nicholson Nuclear Science and Engineering, Cambridge, Mass., (U.S.A.)); Lanning, D.D. Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

An advanced plant surveillance and diagnostic system has been postulated for the purpose of aiding operator response to unanticipated plant upsets. The plant operator is described as an information processor that needs plant status information represented by symbolic outputs. These will be compatible with modern visual processing techniques, such as CRTs. Preferrred methods of estimating the state-of-the-plant and verifying measurements require on-line real-time models which are simple dynamical relationships based on energy and mass conservation laws. Implementation of on-line state estimation techniques using such models probably requires a distributed microcomputer system whose features are described.

524 (AECL—7056, pp 20-31) **Distributed architecture in the control of the PWR 1300 MW nuclear plants of electricite de France.** Guesnier, G.; Varaldi, G. (Electricite de France, 75 - Paris); Peinturier, P. (Compagnie Generale d'Entreprise Electrique - Alsthom, 92 - Levallois-Perret (France)). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

Since 1974, EDF has developed the control and instrumentation technology in its nuclear power plants. Technological improvements in microelectronics led to the development by CGEE ALSTHOM of automation equipment, so called CONTROBLOC, meeting the following objectives: introduction of automation at high security and availability level; progressive implementation in design offices and on sites by operators not specialized in electronics or data processing; great flexibility, permitting the configuration of various systems; survivability to first failure; and capability of self-diagnosis. Characterized by modular, programmed and multiplexed structure with distributed software, the CONTROBLOC equipment is under commissioning in the first 1300 MW nuclear plant. An introduction is given to the main characteristics of the equipment peculiar to 1300 MW power plants, and descriptions are offered of working methods adopted by the design offices, problems met during development, and operating conditions in the first months.

525 (AECL—7056, pp 32-42) **Design of a real-time software system for the distributed control of power station plant.** Maples, G.C. (Central Electricity Research Labs., Leatherhead (UK)). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

As the application of computers to the control of generating plants widens, the problems of resourcing several individual projects over their life cycle can become formidable. This paper indicates the factors relevant to containing the resource requirements associated with software, and outlines the benefits of adopting a standard machine-independent software system which enables engineers rather than computer specialists to develop programs for specific projects. The design objectives which have led to the current development within C.E.G.B. of CUTLASS (Computer Users Technical Languages and Applications Software System) are then considered. CUTLASS is intended to be a standard software system applicable to the majority of future on-line computing projects in the area of generation and is appropriate to stand alone schemes or distributed schemes having a host/target configuration. The CUTLASS system software provides the necessary environment in which to develop, test, and run the applications software, the latter being created by the user by means of a set of engineer-orientated languages. The paper describes the various facilities within CUTALSS, i.e. those considered essential to meet the requirements of future process control applications. Concentrating on the system software relating to the executive functions, and the organisation of global data and communications within distributed systems. The salient features of the engineer-orientated language sets are also discussed.

526 (AECL—7056, pp 43-64) **Distributed control and data processing system with a centralized database for a BWR power plant.** Fujii, K.; Neda, T. (Toshiba Corp., Fuchu (Japan). Fuchu Works); Kawamura, A. (Control and Electrical Engineering Section, Nuclear Energy Group, Toshiba Corp.); Monta, K.; Satoh, K. (Nippon Atomic Industry Group Co. Ltd., Kawasaki, Kanagawa. Nuclear Research Lab.). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

Recent digital techniques based on changes in electronics and computer technologies have realized a very wide scale of computer application to BWR Power Plant control and instrumentation. Multifarious computers, from micro to mega, are introduced separately. And to get better control and instrumentation system performance, hierarchical computer complex system architecture has been developed. This paper addresses the hierarchical computer complex system architecture which enables more efficient introduction of computer systems to a Nuclear Power Plant. Distributed control and processing systems, which are the components of the hierarchical computer complex, are described in some detail, and the database for the hierarchical computer complex is also discussed. The hierarchical computer complex system has been developed and is now in the detailed design stage for actual power plant application.

527 (AECL—7056, pp 65-100) **PROWAY - a standard for distributed control systems.** Gellie, R.W. (National Research Council of Canada, Ottawa, Ontario). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

The availability of cheap and powerful microcomputer and data communications equipment has led to a major revision of instrumentation and control systems. Intelligent devices can now be used and distributed about the control system in a systematic and economic manner. These sub-units are linked by a communications system to provide a total system capable of meeting the required plant objectives. PROWAY, an international standard process data highway for interconnecting processing units in distributed industrial process control systems, is currently being developed. This paper describes the salient features and current status of the PROWAY effort.

528 (AECL—7056, pp 101-118) **Westinghouse designed distributed mircroprocessor based protection and control system.** Bruno, J.; Reid, J.B. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

For approximately five years, Westinghouse has been involved in the design and licensing of a distributed microprocessor based system for the protection and control of a pressurized water reactor nuclear steam supply system. A 'top-down' design methodology was used, in which the system global performance objectives were specified, followed by increasingly more detailed design specifications which ultimately decomposed the system into its basic hardware and software elements. The design process and design decisions were influenced by the recognition that the final product would have to be verified to ensure its capability to perform the safety-related functions of a class 1E protection system. The verification process mirrored the design process except that it was 'bottom-up' and thus started with the basic elements and worked upwards through the system in increasingly complex blocks. A number of areas which are of interest in a distributed system are disucssed, with emphasis on two systems. The first, the Integrated Protection System is primarily responsible for processing signals from field mounted sensors to provide for reactor trips and the initiation of the Engineered Safety Features. The Integrated Control System, which is organized in a parallel manner, processes other sensor signals and generates the necessary analog and on-off signals to maintain the plant parameters within specified limits. Points covered include system structure, systems partitioning strategies, communications techniques, software design concepts, reliability and maintainability, commercial component availability, interference susceptibility, licensing issues, and applicability.

529 (AECL—7056, pp 119-128) **Data management problems with a distributed computer network on nuclear power stations.** Davis, I. (Central Electricity Generating Board, Bristol (UK)). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

It is generally accepted within the Central Electricity Generating Board that the centralized process computers at some nuclear power plants are going to be replaced with distributed systems. Work on the theoretical considerations involved in such a replacement, including the allocation of data within the system, is going on with the goal of developing a simple, pragmatic approach to the determination of the required system resilience. A flexible network architecture which can accomodate expansions in the future and can be understood by non-computer specialists can thus be built up.

530 (AECL—7056, pp 129-140) **Use of distributed micro processors for sodium pre-heating system.** Fujii, K; Satou, J. (Toshiba Corp., Fuchu (Japan). Fuchu Works); Satou, M. (Advanced Reactor Engineering Dept., Toshiba Corp.); Okano, H. (Nuclear Engineering Lab., Toshiba Corp.). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

This article deals with a hierarchy/distributed control system for the sodium system in a Liquid Cooled Fast Breeder Reactor (LMFBR). The control system consists of mini-computers, a computerized control panel, and distributed front-end units with micro-computer. In this system, the concentration of the plant operation information and the distribution of the control function are aimed at improving man-machine communication to increase system availability. The preheating control device with a microcomputer dealing with several thousands of temperature control points and the preheating system to maintain piping and components above the sodium melting temperature has been developed and tested at actual sodium test facilities, and the result satisfies system requirements of the prototype LMFBR.

531 (AECL—7056, pp 141-155) **Distributed systems design using separable communications.** Capel, A.C.; Yan, G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

One of the promises of distributed systems is the ability to design each process function largely independently of the others, and in many cases locate the resulting hardware in close proximity to the application. The communications architecture for such systems should be approached in the same way, using separable communications facilities to meet individual sets of requirements while at the same time reducing the interactions between functions. Where complete physical separation is not feasible and hardware resource sharing is required, the protocols should be designed emphasizing the logical separation of communication paths. This paper discusses the different types of communications for process control applictions and the parameters which need to be characterized in designing separable communications for distributed systems.

532 (AECL—7056, pp 156-166) **Impact of data highway architectures on control and instrumentation design.** McNeil, T.; Hepburn, A.; Olmstead, R. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Power Projects). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

Digital computers have been successfully used in control functions in all CANDU stations since the first commercial demonstration plant. In each successive station design, the computer systems have been enhanced and expanded in their scope of application. The excellent performance of computers in the past provides a basis for expansion of the computer's responsibilities in a new design currently under study. In this new computer system, we intend to add the diverse interlock logic used by individual subsystems in the nuclear steam plant. In current designs this logic is implemented by relays through the extensive use of modern distributed control techniques. The main reason to implement a distributed control system is the advantages it offers in the design and engineering of control/instrumenation systems. By implementing more logic in software, we intend to improve design flexibility and to reduce the impact of late design alterations upon the overall construction schedule. The extensive use of data highways, replacing trunk cabling, should reduce the installation and commissioning effort as well. In this paper we briefly describe the engineering design process as it exists today, and identify some of the problems in this area. We will then look at a new control system architecture and some mechanized tools which become possible with this new approach to aid the design team, project management, and the field commissioning crew.

533 (AECL—7056, pp 168-179) **Design development and commissioning of two distributed computer based boiler control systems.** Collier, D.; Johnstone, L.R.; Pringle, S.T.; Walker, R.W. (Central Electricity Generating Board, London (UK)). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

The CEBG N.E. Region has recently commissioned two major boiler control schemes using distributed computer control system. Both systems have considerable development potential to allow modifications to meet changing operational requirements. The distributed approach to control was chosen in both instances so as to achieve high control system availability and as a method of easing the commissioning programs. The experience gained with these two projects has reinforced the view that distributed computer systems show advantages over centralised single computers especially if software is designed for the distributed system.

534 (AECL—7056, pp 192-197) **Northeast Utilities generic plant computer system.** Spitzner, K.J. (Northeast Utilities Service Company, Hartford, CT (U.S.A.)). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

A variety of computer manufacturers' equipment monitors plant systems in Northeast Utilities' (NU) nuclear and fossil power plants. The hardware configuration and the application software in each of these systems are essentially one of a kind. Over the next few years these computer systems will be replaced by the NU Generic System, whose prototype is under development now for Millstone III, an 1150 Mwe Pressurized Water Reactor plant being constructed in Waterford, Connecticut. This paper discusses the Millstone III computer system design, concentrating on the special problems inherent in a distributed system configuration such as this.

535 (AECL—7056, pp 214-225) **Leak detection system with distributed microprocessor in the primary containment vessel.** Inahara, K.; Yoshioka, K.; Tomizawa, T. (Toshiba Corporation, Tokyo (Japan)). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

Responding to the demand for greater improvements of the safety monitoring system, less public radiation exposure, and increase of plant availability, measuring and control systems in nuclear power plants have undergone many improvements. Leak detection systems are also required to give earlier warning, additional accuracy, and continuous monitoring function. This paper describes the drywell sump leakage detection system utilizing a distributed microprocessor, which is a successful application owing to its versatile function and ease of installation. The microprocessor performs various functions such as a rate of level change computation, conversion to leakage flow rate, initiation of alarm, and sump pump control. This system has already been applied to three operating BWR plants that demonstrate its efficiency.

536 (AECL—7056, pp 226-238) **Distributed terminal support in a data acquisition system for nuclear research reactors.** Shah, R.R.; Capel, A.C.; Pensom, C.F. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

A comprehensive and flexible terminal support facility is being designed to provide the necessary interactive man-machine interface for REDNET, a distributed data aquisition system for nuclear research reactors. Host processors and a large number of terminals are linked via three physically independent but interconnected terminal support subsystems, which use in-house developed equipment based on cable TV technology. The CCITT X-25 protocol is supported, and virtual circuits are used for communications between terminals and software functions in host processors. This paper presents the requirements and conceptual design of the major terminal support components.

537 (AECL—7056, pp 265-281) **Hierarchy of essential CANDU reactor control functions in a distributed system.** Mercier, P. (Hydro-Quebec, Montreal (Canada)). Jul 1980. (In French). Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

Control functions in CANDU nuclear generating stations are programmed within two centralized and redundant minicomputers while safety functions are covered by conventional analog systems. This set-up is a product of standards, economic and technical considerations which are now being modified by the maturing of microprocessors, the progress in digital communications and the development of mathematical process models. Starting from the control and safety systems installed in Gentilly-2, this paper analyses trends that will affect the implementation of essential control functions within a distributed system. In particular, it emphasizes the characteristics of future software systems that must be built-in in order to comply with important operational requirements of nuclear generating stations.

538 **Nuclear reactor surveillance - neutron noise measurements and vibration analysis on French PWR internal structures.** Assedo, R.; Hugot, G. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Paris La Defense (France)); Epstein, A.; Gibert, R.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques). pp F2/2 (1-6) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In a reactor, the internal structures are submitted to vibrations mainly induced by the turbulent excitations of the primary flow. These structures are an important component of the system and to prevent any incidents, it is necessary to follow the vibration behaviour of the reactor. The first thing to do is to define a reference, which consists in the initial signature of the structure motions, then to follow from time to time the evolution of the behaviour, and verify that it does not exist abnormal changes of the signature due to particular phenomena. So, we must find criteria for vibration monitoring, i.e. to give some limits of variations of the main vibration parameters corresponding to a normal behaviour (variation domain for frequencies and maximum levels allowed for amplitudes). It is not simple to reach this step, because for a given reactor, the normal vibration behaviour itself can changes with time, due to variation of many mechanical parameters: fabrication tolerancies, gaps which close, contacts between vessel and core barrel. It is also necessary to performe a lot of measurements on several plants to obtain data, to compare a reactor to an another, to get statistics. In parallel calculations can explain some evolutions of frequencies (introduction of contacts). The experimental program undertaken consists in neutron noise and external accelerometers measurements on several reactors.

## 2205 Environmental Aspects

*REFER ALSO TO CITATION(S) 281, 987, 988, 994*

539 **Protection of the public and environment.** Clarke, T.R. (Ontario Hydro, Toronto (Canada)). pp vp of Proceedings of the symposium on CANDU reactor safety design. Toronto, Ontario, Canada; Canadian Nuclear Association (1978).

From Symposium on CANDU reactor safety design; Toronto, Canada (Nov 1978).

Ontario Hydro nuclear generation stations are designed and operated to maintain radiological emissions at the lowest level practicable. Emission limits are derived to be consistent with the Canadian public radiation dose limits. Emission targets have been adopted which are 1% or less of the emission limits. In 16 years (56 unit years) of operation, no plant has ever exceeded an annual emission limit and no member of the public has ever received a radiation dose from a nuclear generating station in excess of the public dose limits. Radiological monitoring shows that the emission targets are usually being met by substantial margins and that public radiation doses in the vicinity of generating stations are very small fractions of public dose limits and natural background radiation.

## 2206 Research, Test, And Experimental Reactors

*REFER ALSO TO CITATION(S) 536, 987, 988*

540 (EUR—6813(Vol.2), pp 1051-1061) **Proton-recoil neutron spectroscopy at the Pool Critical Assembly.** Rogers, J.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

Fast neutron spectrum measurements have been made in the Pool Critical Assembly (PCA) associated Light Water Reactor (LWR) Dosimetry Pressure Vessel Benchmark (PVB) fields. These measurements cover the neutron energy range between approximately 60 keV and approximately 2 MeV. Hydrogen and methane filled proton-recoil detectors were used to obtain the proton-recoil spectra from which the neutron spectra were derived. Measurements were taken at the midplane elevation on the surface, at 1/4 thickness of the steel, at 1/2 thickness of the steel and in the void box positions of the PVB. The neutron spectra showed considerable variation at the various positions with the energy distribution shifting toward lower energy between the face and void box of the PVB. In a similar manner considerable spectral structure developed in the spectra. These measurements were performed to provide neutron spectra. These measurements were performed to provide neutron spectral definition which is required to appropriately perform and interpret neutron dosimetry measurements related to fast neutron damage in light-water pressure vessel steels. These measurements also provide data for comparison with calculated spectra.

541 (KFTI—78-64, pp 55-67) **Peculiarities of investigations in reactor channels.** Samsonov, B.V.; Tsykanov, V.A. (Nauchno-Issledovatel'skii Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1978. (In Russian). Dep. NTIS (US Sales Only).

From School on radiation damage physics of solids; Alushta, Ukrainian SSR (27 Sep 1977).

Given is a description of devices designed for intrachannel mechanical, thermo-and electro-physical measurements and investigations on the output of gaseous fission products in the SM-2 and RBT-6 research reactors. In particular assemblies designed to perform tests without measuring deformation (long-term strength) and tests providing the measurement of deformation (creepage), and an instrument for testing tubular samples at two-axial loading are described. Using fuel elements with uranium dioxide as an example, a technique for investigations of the thermal conductance of a fuel-can gap of the fuel element is given. Described are cells used to measure the electric conductivity of solid dielectrics and of the methods for determining the increase in leakage currents in a sample under the action of irradiation. Basing on the researches of fuel compositions the technique for studying gas release is presented. For this purpose two circuits were used: an open one, when gases emanating from a sample were analyzed and then dumped, and a closed one, when the gases were accumulated in a certain volume and then the kinetics of this accumulation was analyzed. The description of instruments designed to measure pressure in fuel elements and structures of pressure indicators provided with elastic elements in the form of bellows or diaphragms are presented.

542 (KURRI-TR—192, pp 12-17) **RERTR/ANL-KURRI results and comparison on reduced enrichment for the KUHFR.** Woodruff, W.L. (Argonne National Lab., IL (USA)); Hayashi, M.; Shiroya, S.; Kanda, K. 1979. Dep. NTIS (US Sales Only).

From Meeting on research reactors using middle-enrichment uranium; Kumatori, Osaka, Japan (30 Jan 1979).

This report provides a summary of some of the preliminary results obtained in the joint RERTR/ANL-KURRI program to study the options available for using medium-and low-enrichment fuel in the KUHFR. The first section of the report is devoted to a brief description of the methods and models used for cross-section preparation and analysis at ANL, the next section is a summary of some of the results and comparisons of ANL and KURRI data, and the last section provides some preliminary results for the enrichment effects on the depletion of $^{235}U$ with burnup.

543 (KURRI-TR—192, pp 6-11) **Technical problems in case of utilizing uranium of medium enrichment for a research reactor.** Kanda, K.; Shibata, H. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1979. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on research reactors using middle-enrichment uranium; Kumatori, Osaka, Japan (30 Jan 1979).

Usually, highly enriched uranium of 90 - 93% is used for research reactors, but the US government proposed the strong policy to use low enriched uranium of the uranium of medium enrichment in unavoidable case from the viewpoint of the resistance to nuclear proliferation in November, 1977. This policy is naturally applied to Japan also. The export of highly enriched uranium will be permitted only when the President approves it after the technical and economical evaluations by the government. The Kyoto University high flux reactor has the features which are not seen in other research reactors, such as medical irradiation, and it is hard to attain the objectives of researches unless HEU is used. The application for the export of HEU was accepted in February, 1978. The nuclear characteristics of the KUHFR when medium or low enriched uranium is used, the criticality experiment in the KUCA using the uranium of medium enrichment, and the burning test on the uranium fuel plates of medium enrichment are described. The research project to lower the degree of enrichment in the fuel for research and test reactors is expected to be continued down to less than 20%. The MEU of 45% enrichment will be actually used in 1983.

544 **Propagation experiments in steel-sodium media at TAPIRO.** Carta, M.; De Carli, A.; Rado, V. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari); Salvatores, M.; Trapp, J.P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). pp 263-277 of Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, Paris, 27-29 October 1980. Paris, France; OECD (1981). (In French)

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

The experimental results and the analysis of the neutron propagation experiments in different SS/Na mixtures performed at TAPIRO reactor in the framework of the CEA/CNEN collaboration on the Fast Reactor Physics, are presented. The observed discrepancies between calculation and experiment depend on the different detectors and mixture of propagation, but the general trend is that the calculation underestimates the experimental value, as observed in the previous series of experiments in pure Na.

## 2209 Reactor Safety

*REFER ALSO TO CITATION(S) 181, 995, 1187*

545 (AECL—7056, pp 306-317) **Fail-safe design criteria for computer-based reactor protection systems.** Keats, A.B. (UKAEA Atomic Energy Establishment, Winfrith). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

The increasing quantity and complexity of the instrumentation required in nuclear power plants provides a strong incentive for using on-line computers as the basis of the control and protection systems. On-line computers using multiplexed sampled data are already well established but their application to nuclear reactor protection systems requires special measures to satisfy the very high reliability which is demanded in the interests of safety and availability. Some existing codes of practice relating to segregation of replicated subsysttems continue to be applicable and lead to division of the computer functions into two distinct parts. The first computer, referred to as the Trip Algorithm Computer may also control the multiplexer. Voting on each group of status inputs yielded by the trip algorithm computers is performed by the Vote Algorithm Computer. The conceptual disparities between hardwired reactor-protection systems and those employing computers also give rise to a need for some new criteria. An important objective of these criteria, minimising the need for a failure-mode-and-effect-analysis of the computer software, but is achieved almost entirely by 'hardware' properties of the system: the systematic use of hardwired test inputs which cause excursions of the trip algorithms into the tripped state in a uniquely ordered but easily recognisable sequence, and the use of hardwired 'pattern recognition logic' which generates a dynamic 'healthy' stimulus for the shutdown actuators only in response to the unique sequence generated by the hardwired input signal pattern. The adoption of the proposed design criteria ensure not only failure-to-safety in the hardware but the elimination, or at least minimisation, of the dependence on the correct functioning of the computer software for the safety system.

546 (AECL—7056, pp 318-323) **Intelligent safety system concept for future CANDU reactors.** Hinds, H.W. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting on distributed systems for nuclear power plants; Chalk River, Canada (14 May 1980).

A review of the current Regional Over-power Trip (ROPT) system employed on the Bruce NGS-A reactors confirmed the belief that future reactors should have an improved ROPT system. We are developing such an 'intelligent' safety system. It uses more of the available information on reactor status and employs modern computer technology. Fast triplicated safety computers compute maps of fuel channel power, based on readings from prompt-responding flux detectors. The coefficients for this calculation are downloaded periodically from a fourth supervisor computer. These coefficients are based on a detailed 3-D flux shape derived from physics data and other plant information. A demonstration of one of three safety channels of such a system is planned.

547 (INIS-mf—6423, pp vp) **Certain aspects of operation safety of nuclear power plants.** Stehlik, J. (Vyskumny Ustav Energeticky, Jaslovske Bohunice (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

One of the most important requirements for operation safety is the quality of material, the method of producing the material, and the type and amount of micro-additions. For fast reactors, the principle of safety and reliability is based on meticulous observance of all regulations for work with alkali metals. A set of requirements is given which are emphasized in designing and operating liquid sodium facilities.

548 (INIS-mf—6423, pp vp) **System and equipment for securing operation safety of experimental stand.** Paryzek, R. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

Safety systems were built for the indication of sudden sodium release into the environment, fire protection, the disabling of the undesirable simultaneous operation of the individual assemblies or impermissible changes in any of the parameters, the indication of lead insulation damage, of thermal shifts on critical sites of the sodium loop, etc. The laboratory is provided with a control computer and portable display units.

549 (INIS-mf—6423, pp vp) **Securing operation safety of liquid sodium test facilities by measurement and control means.** Svoboda, N. (Sigma, Prague (Czechoslovakia). Vyzkumny Ustav Cerpacich Zarizeni, Potrubi a Armatur). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The operating safety assurance system consists of subsystems interconnected such as to secure the maximal prevention of accident situations and to allow remote control. It includes the system of electric heating and its control, the control system for the drive of machines, pumps, fans and valves, the thermal control system, the limit state alarm system, the blocking system, and the accident protection system.

550 (IWGFPT—7, pp 21-36) **Development of a burst criterion for Zircaloy fuel cladding under LOCA conditions.** Rosinger, H.E. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment); Neitzel, H.J.; Erbacher, F.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A burst criterion model, which assumes that deformation is controlled by steady-state creep, has been developed for thin-walled Zircaloy-4 cladding subjected to a differential pressure and high temperature. The creep equation is integrated to obtain a burst time at the singularity of the strain. Once the burst time is determined, the burst temperature and burst pressure are calculated from the known temperature and pressure histories. A relationship between burst stress and burst temperature then determines the burst strain. Experimental burst data show good agreement with theoretical predictions. It was found that, if the heating rate is constant, the burst temperature increases with decreasing stress. If the stress level is constant, the burst temperature increases with increasing heating rate. If the burst temperature is constant, the burst strain increases with decreasing heating rate. Anisotropy alters the burst temperature and burst strain.

551 (IWGFPT—7, pp 44-55) **Semi-empirical evaluation studies on PCMI for the Fugen fuel rod.** Domoto, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Kaneko, M.; Takeuchi, K. (Nuclear Fuel Industries Ltd., Tokyo (Japan)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

Fugen, 165 MWe prototype of a heavy water moderated boiling water cooled reactor, has been well operated since March 1979. In order to establish PCIOMR for Fugen fuels semi-empirical evaluation code to analyze PCMI during power transient of the fuel rod has been developed. In this paper, the following are described: (1) general scope of the development work, (2) description of the modelling, and (3) some results of analysis on out pile and in pile tests.

552 (IWGFPT—7, pp 133-137) **MABEL-2. A code to analyze cladding deformation in a loss-of-coolant accident: status.** Bowring, R.W.; Cooper, C.A. (UKAEA Atomic Energy Establishment, Winfrith); Gittus, J.H.; Haste, T.J. (UKAEA Springfields Nuclear Power Development Labs.). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

MABEL-2 calculates the deformation of a single fuel rod. This rod is surrounded by 8 other rods on a square lattice whose behavior is specified via Input Data options. A 2-D $(r,\theta)$ conduction model is used for the fuel rod, the cladding creep is calculated from the CANSWEL-2 model and the feedback effect of clad strain on heat transfer to the coolant is obtained from subchannel analysis of the coolant passages surrounding the rod. The coding of the first version of MABEL-2 has been completed except for work to optimize the iteration convergence, minimise the running time and generally tidy up the coding.

553 (IWGFPT—7, pp 160-167) **Fission gas release during anticipated PWR transients.** Pati, S.R.; Ritterbusch, S.E. (Combustion Engineering, Inc., Windsor, CT (USA)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

Under a program sponsored by the Electric Power Research Institute, Combustion Engineering is investigating the feasibility of a post-DNB fuel design limit which could result in improved reactor performance and availability. As a part of this study, an empirical model for transient fission gas release has been developed and applied in the analysis of anticipated PWR transients. The fission gas release model is based on measurements of gas release from pre-irradiated fuel samples which were exposed to simulated transients in the Direct Electrical Heating (DEH) Tests at the Argonne National Laboratory. The fuel samples were obtained from H.B. Robinson-2 commercial fuel rods which had achieved peak burnups of 29.5 MWd/kgU at peak linear heat generation rates of 22.4 kW/m. Detailed temperature histories from nine of these tests were used in the derivation of an empirical correlation of transient fission gas release. Local fuel temperature and time at that temperature are the explicit variables used in the model. The model was programmed into STRIKIN-II and applied to the analysis of six PWR transients. For these transients, short-term increases in fuel centerline temperatures ranged from zero to 1650°K, and the predicted transient gas release varied from zero to about 4% of the pre-transient fuel pellet fission gas inventory. The results indicate that the effect of transient fission gas release on fuel rod internal pressures is not significant for conventional fuel management (batch average burnups up to about 35 MWd/kgU).

554 (IWGFPT—8, pp 203-225) **Modelling of overpower transients with Gapcon-Thermal-3 code.** Seppae, E.K.; Ojanen, M. (Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)); Vilpponen, K.O. (Institutt for Energiteknikk, Halden (Norway). OECD Halden Reaktor Prosjekt). Jan 1981. Dep. NTIS (US Sales Only).

From Specialists' meeting on pellet-cladding interaction in water reactors; Roskilde, Denmark (22 Sep 1980).

Overpower ramps at high burnup impose severe conditions for water reactor fuel rods through the combined effect of chemical attack and mechanical interaction. Fuel rod thermal and mechanical behaviour during overpower transients calculated with Gapcon-Thermal-3 code is compared to experimental data from fuel rods irradiated in the Halden reactor and Studsvik's Inter-Ramp-Project. For estimating fission gas release during ramps the code has been modified to include a transient fission gas release model. Transient fission gas release and its feedback effect on fuel rod temperatures, clad strain levels during ramps as well as relaxation phenomena after the ramps are discussed in context with fuel failures. Different fuel rod failure criteria are evaluated.

555 (IWGHTR—2, pp 114-125) **Development and testing of a liner venting system.** Menon, S.; Johnsson, B. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Mar 1979. Dep. NTIS (US Sales Only).

From Vessel concepts for gas-cooled reactors; Lausanne, Switzerland (23 Oct 1978).

Prestressed Concrete Pressure Vessels are relatively thick-walled and are designed on the basis of internal pressure acting on a leak-tight liner. If a crack should develop in this liner, the pressurization of concrete could reduce the vessel's factor of safety against failure. Some existing PCRV codes for GCRs attempt to cope with this problem by designing the vessel for an assumed worst case. The Scandinavian criteria tries to limit the pressure load by venting away the leaking gas. For designing the venting system, an analysis was made of the potential leakage paths for gas through concrete. Based on the results of the analysis a design basis crack of 0.2 mm in the liner was postulated. The venting system itself consists of two layers (one vertical, one helical) of cored-out ducts in the heavily reinforced concrete adjacent to the liner. This layer of concrete functions as the catchment area for the venting system. A model with an I/D of 1.8 m and wall thickness of 0.8 m, was judged to be adequately large for testing the outward transport of gas through the vessel wall and the function of a system to vent this gas. Liner cracks were simulated by rows of 4 mm holes. The catchment area of the venting system was represented in full scale to simplify correlation of test results with a full-size vessel. After pilot tests on a 2.1 m O/D ring, the pressure vessel model was built during March-June 1974. Leakage flows and pressure profiles in concrete were studied at 40, 70, and 85 ato. Measurements were made without venting and compared with those with the leakage vented.

556 **EMPs and nuclear power.** Lerner, E.J. *IEEE (Institute of Electrical and Electronics Engineers) Spectrum;* **18**: No. 6, 48-49(Jun 1981).

The paper reflects the studies of the US Nuclear Regulatory Commission on a possibility of triggering nuclear plant accidents by electromagnetic pulses from H-bombs. 2 refs.

557 **Model of countercurrent steam-water flow in large horizontal pipes.** Daly, B.J.; Harlow, F.H. (Los Alamos Sci Lab, NM). *Nuclear Science and Engineering;* **77**: No. 3, 273-284(Mar 1981).

A numerical study was performed to derive a model of countercurrent steam-water flow in large horizontal pipes, with application to the emergency core cooling (ECC) system of a pressurized water reactor. The purpose of the study was to provide data from which simple correlations could be obtained to describe mass, momentum, and energy exchange between the phases during hot leg ECC injection. Several series of calculations were performed to determine the sensitivity of the ECC flow velocity at the entrance to the reactor vessel to the pressure drop, for several values of the mass and momentum exchange coefficients used in the numerical method. 27 refs.

558 **RELAP4/MOD6 reflood heat transfer and data comparison.** Nelson, R.A.; Sullivan, L.H. (Idaho National Engineering Lab., Idaho Falls (USA)). pp 331-363 of Transient two-phase flow. Proceedings of the second CSNI specialists meeting, Paris, 12-14 June 1978. Vol. 1. Reocreux, M.; Katz, G. (eds.). Paris, France; Commissariat a l'Energie Atomique (Feb 1981).

From Meeting on transient two-phase flow; Paris, France (12 Jun 1978).

This discussion of RELAP4/MOD6 will be limited to the reflood heat transfer models and evaluation of these models by

comparison of calculation with results from three reflood experiments. The discussion of the model includes the heat transfer surface concept, the heat transfer correlations, the superheat model and the entrainment model which presents both the two-phase heat transfer and hydraulic models. In the discussion of the reflood heat transfer, the mathematical concept of a multidimensional surface is used to represent the heat flux of a given heat transfer correlation or correlations dependent upon such variables as quality, wall superheat and flux. This concept has been used to investigate the characteristics of the correlations, which are discusssed in detail, and the way they are applied to the two-phase mixture. Of primary importance in the reflood core heat transfer is the consideration of thermal nonequilibrium between the phases and the liquid entrainment, and its distribution up the core. Results obtained to date show the heat transfer and hydraulics to be closely coupled. Comparison of the RELAP4/MOD6 reflood calculations with the data from the forced feed FLECHT and gravity feed FLECHT-SET and Semiscale reflood experiments indicates that the heat transfer and hydraulic models are operational and yield good results.

559 **Reactor safety, analysis and prognosis.** Farmer, F.R. pp 235-244 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

In this paper it is intended to outline the trends which have influenced the development of safety thinking and practices and to predict possible future influences from technology, or from local or more distant external pressures. The subject is covered under the headings: safety themes (siting; containment, automatic built-in safety mechanisms); safety guidelines; outlook for the future; conclusions.

560 **Behavior of defective pressurized water reactor fuel rods during power ramp and power-cooling-mismatch conditions.** Croucher, D.W. (Edgerton, Germeshausen and Grier Inc, Idaho Falls, Idaho). *Nuclear Technology;* **51**: No. 1, 45-57(Nov 1980).

Three pressurized water reactor type fuel rods that contained defects representative of those occasionally found in the cladding of commercial reactor fuel rods, that is, a hydrided region, a pinhole-type defect, and an axial crack, were tested under power ramp and power-cooling-mismatch conditions. Operation of the hydrided fuel rod in a power ramp caused a cladding rupture at the location of hydriding and degraded the thermal performance of the rod. 19 refs.

561 **Influence of gas generation on melt/concrete interactions.** Powers, D.A. (Sandia Labs., Albuquerque, NM (USA)). pp 351-365 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

Gases formed during the interaction of a high-temperature melt with concrete are shown to stem from the thermal dehydration and decarboxylation of the concrete. Values of the rate constants for the decomposition reactions in three varieties of concrete are presented. Gases evolved from a horizontal concrete surface escape preferentially into the melt at localized sites on either side of the centre-line of the melt. Extensive gas evolution occurs at vertical concrete surfaces attacked by a melt. When gas evolution rates are sufficiently great vertical surfaces may be partially shielded from the melt. Gases within the melt cause an apparent swelling of the melt. The observed swelling is not easily correlated to the rate of gas evolution. Metallic melts cause carbon dioxide and water liberated from the melt to be reduced to carbon monoxide and hydrogen. When these gases escape from the melt they assist in aerosol formation. A linear correlation between aerosol concentration and gas evolution rate is suggested. As the gases cool they react along a pathway whose oxygen fugacity is apparently buffered by the iron-Wustite equilibrium. Methane is a product of the gas-phase reaction.

562 **Interaction of molten 'corium' with concrete in a hypothetical LWR core-melt-down accident. Oxidation of core materials and hydrogen production.** Peehs, M.; Hassmann, K. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 367-379 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

Concrete degradation occurs only due to the thermal load applied. One of the main reasons for this is the oxidation by water released from the concrete of the metallic 'Corium' components, preventing possible reactions with the oxides from the concrete. (Corium is a term coined to describe the heterogeneous mass deriving from a reactor core after melt down.) The water released from the heated concrete oxidizes the metals in the following sequence: $Zr \rightarrow ZrO_2$, $Cr \rightarrow Cr_2O_3$, $Fe \rightarrow FeO$. The oxygen potential of the Corium melt was determined to be about -300 kJ/mol. Only when all the iron is converted into FeO will a further increase of the oxygen potential occur, converting $FeO \rightarrow Fe_2O_3$ and $Ni \rightarrow NiO$. Corresponding amounts of $H_2$ are generated during the oxidation of the Corium components. Numerical calculations for a 1300 MW(e) PWR show that all metals in the Corium are oxidized in about 4.5 days. By 10 days some 2000 t of concrete are molten, the overall mass of the melt being 2700 t.

563 **Some radiation protection implications of the Three Mile Island incident.** Ilberg, D. (Israel Atomic Energy Commission, Tel Aviv. Licensing Div.). pp 690-692 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Four safety problems arising from the Three Mile Island (TMI) nuclear accident are discussed and the recommendations made by the Nuclear Regulatory Commission and the Kemeny Commission to deal with them are reported. The problems are (a) delay or prevention of the use of safety systems important to the recovery operations, (b) undue exposure of operating personnel, (c) failure of radiation protection instrumentation and monitors to provide correct information, and (d) failure of evaluating radiation protection measurements, alarms and other information to determine the actual reactor situation. Additionally, it is also suggested that a dollar value per man-rem should be used as a criterion for determining when design improvements are required rather than procedural controls.

564 **United States programme for regulating radioactive airborne releases from licensed nuclear facilities.** Hickey, J.W.N. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Standards Development). pp 45-55 of Management of gaseous wastes from nuclear facilities. Proceedings of an international symposium jointly organized by the IAEA and the NEA of the OECD and held in Vienna, 18-22 February 1980. Vienna, Austria; International Atomic Energy Agency (1980).

From International symposium on management of gaseous wastes from nuclear facilities; Vienna, Austria (18 Feb 1980).

The United States Nuclear Regulatory Commission regulates about 20,000 licensees in the USA: 8000 directly and another 12,000 indirectly through individual States. However, relatively few facilities have a potential for significant airborne releases to the environment. The regulatory programme for airborne releases from these major nuclear facilities is described. The programme includes general standards, licensing procedures, inspections, and enforcement actions. Control equipment in use, resulting releases, and radiation dose estimates are discussed. In general, NRC licensees operate such that maximum radiation doses to individual members of the public are below 25 millirems per year.

565 **In situ and laboratory testing of iodine filters in Italy.** Lanza, S.; Mazzini, M. (Pisa Univ. (Italy). Ist. di Impianti Nucleari); Pisani, U. (Ente Nazionale per l'Energia Elettrica, Trino Vercellese (Italy)). pp 315-330 of Management of gaseous wastes from nuclear facilities. Proceedings of an international symposium jointly organized by the IAEA and the NEA of the OECD and held in Vienna, 18-22 February 1980. Vienna Austria; International Atomic Energy Agency (1980). (In French)

From International symposium on management of gaseous wastes from nuclear facilities; Vienna, Austria (18 Feb 1980).

This paper reports on the latest results from efficiency tests performed on iodine adsorption systems in Italy. In situ and laboratory trials were organized. A description is given of the results of trials with $ICH_3$ at Saluggia using zeolite beds and at Ispra using activated charcoal rod assemblies. A study is also made of the experience acquired using freon to check the filtering system in the Trino Vercellese nuclear power plant. Laboratory tests were carried out in parallel by the Istituto di Impianti Nucleari at the University of Pisa. Lastly, the paper presents and comments upon the results of efficiency tests on a number of activated charcoals, including those used at Ispra and Trino Vercellese.

566 **Emergency planning and preparedness. Pre- and post-Three Mile Island.** Collins, H.E. (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). pp 773-780 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Emergency planning and preparedness for a major nuclear accident are examined in the light of events following the accident at the Three Mile Island reactor. Problems discussed in detail include adequate planning basis, accident assessment, training, funding and emergency planning guidance. The concept of emergency planning zones for airborne plume radiological exposure (about 10 miles) and radiological exposure from ingestion of food (about 50 miles) are described. Also mentioned is a system for rapidly providing offsite information on atmospheric and radiological assessments. It is concluded that emergency planning has received too little attention to date.

567 **Extent of emergency actions for the protection of the public after accidental activity releases from nuclear power plants.** Huebschmann, W.G.; Bayer, A.; Burkart, K.; Vogt, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). pp 781-784 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Results are reported for modelling the external radiation dose from the ground occurring after a nuclear accident which releases radioactive material into the atmosphere. The areas contaminated are classed into 4 areas depending on the extent of contamination and the appropriate action to be taken in each area is listed. Various weather conditions and methods of depositing the radioactivity from the atmosphere to the ground are included in the computer programs. Activity concentration and ground contamination are calculated at discrete mesh points, and the effects of using fine and coarse-mesh grids are discussed. It is shown that the average areas covered by protective actions are only negligibly affected by model refinements.

568 **Reactor safety requirements in times of change.** Domaratzki, Z. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). pp 24-37 of 20. annual international conference. Toronto, Ontario; Canadian Nuclear Association (1980).

From Annual conference of the Canadian Nuclear Society; Montreal, Quebec, Canada (18 Jun 1980).

The safety requirements of the Atomic Energy Control Board for nuclear power plants continue to evolve around the previously established fundamental criteria and principles. The good and the poor experience with power plants in recent years has resulted in some changes and shifts in emphasis in the requirements. The Board has also considered proposals for major changes to the safety requirements which would involve a much greater use of probabilities in the safety review. Licensing guides have been prepared which largely follow current practice but also reflect some of the proposed changes.

569 **Protecting front-line survey and rescue teams during emergencies.** Tresise, H. (Central Electricity Generating Board, Gloucester (UK). Oldbury Nuclear Power Station). pp 794-797 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

This paper describes the methods and equipment used to protect rescue teams in British civil nuclear power plants during an emergency. Each team consists of a minimum of 5 trained men, all equipped with breathing apparatus. The teams always consist of a plant engineer, a person to make radiological measurements and someone with a knowledge of first aid. The hazards which may be encountered include fire or high temperatures, smoke or poor visibility, concentrations of irrespirable gas, unsafe access routes and high levels of radiation or contamination. The setting up of a incident control point and all the procedures which must be followed are described. The use of a mobile store for control point equipment has proved invaluable.

570 **Application of cost-effectiveness analysis to restrict the damage caused by accidental release of radioactive material to the environment.** Frittelli, L.; Tamburrano, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). pp 785-789 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A cost-effective analysis is applied to the problem of restricting the damage caused by an accidental release of radioactive material to the environment. The cost of remedial actions is compared with the monetary value of the collective dose avoided by these actions. After describing the methodology used, the results for various 'standard' accidents in PWR are given. Results are also given for various values of the monetary value of health damage ($ per man Sv). If remedial action were managed only on the basis of cost-effective analysis, an intervention plan for reducing social damage would be justified only for large and mean extent accidents; however, no account has been taken of psychological factors.

571 **Numerical methods for engineering.** Absi, E.; Glowinski, R.; Lascaux, P.; Veysseyre, H. (eds.). Paris, France; Dunod (1980). vp. (CONF-801207—(Vol.1)).

From GAMNI international symposium on numerical methods in engineering; Paris, France (1 Dec 1980).

Separate abstracts were prepared for individual items in scope. (DLC)

572 **Performance of Scandinavian BWR-containments during pressure tests.** Engelbrektson, A. (Vattenbyggnadsbyraan, Stockholm (Sweden)); Boye-Moeller, K. (Swedish State Power Board, Vaellingby). pp J6/5 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Seven prestressed concrete containment vessels for ASEA-ATOM's BWR-reactor have been constructed in Sweden during the last ten years and two similar vessels have been built in Finland. The vessels have been subjected to the usual pre-operational pressure tests in order to demonstrate their structural integrity and leaktightness and some of the structures have also been retested in compliance with the usual demands for periodic testings. Observation data from all these tests have been compiled and experiences are summarized and compared with theoretical predictions.

573 **Structure-to-structure interaction analysis for a nuclear power plant.** Mueller, C.; Furrer, H. (Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland)). pp K6/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. K(a). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The effect of mutual dynamic interaction of buildings, the so-called throughsoil coupling is analysed for a BWR power station. As a consequence of the various buildings involved and their geometrical arrangement, a three-dimensional approach is used.

574 **Nonlinear analysis of a BWR reactor building subjected to both thermal and earthquake loadings.** Muto, K.; Tsugawa, T. (Muto Inst. of Structural Mechanics, Inc., Tokyo (Japan)); Aihara, S.; Ujiie, K. (Kajima Corp., Tokyo (Japan)). pp K8/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

It is a well known fact that when a reinforced concrete member is subjected to thermal loads, there occurs cracking which decreases overall member stresses. However, the influence of thermal cracks on earthquake response of a structure has not yet been discussed. The object of this paper is to clarify both thermal and dynamic nonlinear behaviors of the BWR MARK II type reactor building which is composed of thick walls such as a shield wall, inner and outer structure walls.

575 **Dynamic pressures in annulus-shaped pressure suppression pools of boiling water reactors generated by earthquake ground motions.** Bedrosian, B.; Ettouney, M.; Brennan, J. (Burns and Roe, Inc., Woodbury, NY (USA)). pp K12/11 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Pressure-suppression pools of annular-circular geometry are used in containments for boiling water reactor (BWR) plants of Mark II and Mark III configurations and must be designed to withstand earthquake effects. Analytical solutions are obtained for dynamic pressures and free-surface displacements (sloshing) induced in annular-circular water pools with horizontal (flat) bottom when subjected to earthquake ground motions. Water is modeled as an inviscid, compressible fluid and free surface effects (sloshing) are accounted for. The pool boundaries are assumed rigid. Analytical solutions are obtained in the frequency domain as Fourier-Bessel or Fourier-Modified Bessel functions depending upon the magnitude of the exciting (forcing) frequency and the compressibility of water.

576 **Computer program system for structural design of nuclear power plants.** Aihara, S.; Atsumi, K.; Sasagawa, K.; Satoh, S. (Kajima Corp., Tokyo (Japan). Architectural Design Div.). pp M1/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. M. Methods for structural analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In German)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In recent days, the design method of the Nuclear Power Plant has become more complex than in the past. The Finite Element Method (FEM) applied for analysis of Nuclear Power Plants, especially requires more computer use. The recent computers have made remarkable progress, so that in design work manpower and time necessary for analysis have been reduced considerably. However, instead the arrangement of outputs have increased tremendously. Therefore, a computer program system was developed for performing all of the processes, from data making to output arrangement, and rebar evaluations. This report introduces the computer program system pertaining to the design flow of the Reactor Building.

577 **Super element model development and analysis on the Mark I torus structure.** Hua, L.C. (Bechtel Power Corp., San Francisco, CA (USA)). pp M3/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. M. Methods for structural analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The Mark I BWR pressure suppression system consists of a toroidal shell suppression chamber and a vent pipe system. The suppression system is presently under structural performance evaluations for the static and dynamic loads resulting from the Loss-of-Coolant Accident (LOCA) and Safety Relief Valve (SRV) discharge. This evaluation necessitates the accurate determination of the system response and structural stresses under all SRV and LOCA related loading conditions. The purpose of this report is to describe the development of a finite element model and analysis procedures, using the 'super element' capability of the NASTRAN computer program, for the static and dynamic analysis of the Mark I torus structure; and to present the results of the analyses performed in this work for a specific Mark I torus.

578 **Some aspects of the interaction between systems- and structural reliability.** Schueller, G.K. (Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Bauingenieurwesen 3 - Massivbau, Stahlbau); Kafka, P. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)); Schmitt, W. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp M8/1 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. M. Methods for structural analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The purpose of this paper is to study the interaction between systems- and structural reliability analysis with reference to the design of structural components of LWR. Presently the evaluation of systems reliability is carried out apart from structural reliability analysis. Moreover, two basically different methodologies are used for analysis. While in systems analysis the simplified binary approach is still generally accepted, in structural reliability one has to resort to more sophisticated procedures to obtain realistic results. The interactive effect may be illustrated as follows: For example, the integrity of the primary circuit interacts with the integrity of the containment structure. This means that the probability of occurrence of the pipe rupture which may cause a LOCA and consequently leads to a build-up of temperature and pressure within the containment affects directly its structural reliability. The piping system, particularly the primary piping, in turn interacts with the protective system, which is part of the safety system. This piping structure is also subjected to various operational loading conditions. In a numerical example dealing with leakage probabilities of pipes it is shown how methods of structural reliability may be used to gain more insight in the estimation of failure rates of system components.

579 **Fluid-structure interactions in PWR vessels during blowdown. Code development at Karlsruhe and results.** Schumann, U.; Enderle, G.; Katz, F.; Ludwig, A.; Moesinger, H.; Schlechtendahl, E.G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp B6/1 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. B. Thermal and fluid/structure dynamics analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

For analysis of blowdown loadings and dynamic response of PWR vessel internals several computer codes have been developed at Karlsruhe. The goal is to provide advanced codes which permit a 'best estimate' analysis of the deformations and stresses of the in-

ternal structures, in particular the core barrel, such that the safety margins can be evaluated. The stresses reach their maxima during the initial subcooled period of the blowdown in which two-phase phenomena are important in the blowdown pipe only. In this period, the computed results with and without fluid-structural interactions show that the coupling between the water in the downcomer and the rather thin elastic core barrel is of dominant importance. Without coupling the core barrel oscillates with much higher frequencies than with coupling. The amplitudes and stresses are about twice as large initially. Later, the decoupled analysis can result in a meaningless overestimation of the structural response. By comparison of computations for incompressible and for compressible fluid with and without coupling we have found that a correct treatment of the fluid-structure coupling is more important than the description of pressure waves.

580 **MEL finite element analysis of water-shell interactions in the context of a PWR-LOCA.** Verbiese, S. (Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture, Brussels (Belgium); Vrije Universiteit Brussels (Belgium). Inst. de Mecanique Applique); van Goethem, G. (Commission of the European Communities, Ispra (Italy). Systems Analysis Div.). pp B6/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. B. Thermal and fluid/structure dynamics analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In the framework of the computational effort engaged towards and understanding of the transient dynamic fluid-structure phenomena taking place in the very first instants of the PWR loss-of-coolant-accident, before the ebullition crisis and the subsequent two-phase flow, two finite element programs have been selected and coupled to describe this class of events in pressure vessels undergoing moderate plastic deformations. Water is modeled by a compressible inviscid Eulerian (bulk of the fluid) - mixed Eulerian-Lagrangian MEL (boundary elements in contact with the moving structure) program. For the shells a convected coordinates elastic-plastic structural code (EURDYN I) is used. A 1-D discussion on the MEL integration scheme is presented, as well as a flow chart of the combined program. Emphases is placed, during the present calculations limited to very simple axisymmetric configurations, upon the computational aspects in dealing with the interaction of both media at the fluid-structure interface, such as weak code coupling, subcycling and pressure relaxation.

581 **Analysis of the RS16B experiment on fluid-structure interactions during PWR blowdown.** Schumann, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp B6/4 (1-6) of Structural mechanics in reactor technology. Transactions. Vol. B. Thermal and fluid/structure dynamics analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

For analysis of fluid-structure interactions during blowdown of a pressurized water reactor (PWR) the code FLUX2 has been developed. This code is based on a three-dimensional compressible potential flow model and a linear elastic structural model. For assessment of the validity of the code the computed results are compared with the measurements in the RS16B experiment (case DWR5) at Batelle (Frankfurt, 1977). In the experiment a sudden depressurization of a vessel (height 11.2 m, diameter 0.8 m) with internal structures is studied under PWR conditions. The initial pressure is 14.2 MPa, saturation pressure is 6.4 MPa. Of particular interest are the loadings on the core barrel. The core barrel wall is relatively thin (8 mm) in the upper third while thicker (18 mm) in the lower thirds. In FLUX2, bulk friction is included in form of a drag force proportional to the local fluid velocity with a constant friction coefficient. Its magnitude had to be taken relatively large; otherwise the pressure oxcillations are larger than found experimentally. The speed of sound is assumed to be a constant as it is appropriate for sub-cooled water. At the break, where two-phase flow appears, the pressure is prescribed to drop linearly from the initial value to saturation pressure within the experimentally found break time of 1 ms. The upper thin part of the core barrel is represented by the shell model CYLDY2 whereas the lower part is treated as a rigid body like the mass ring CYLDY2.

582 **Dynamic behavior of a PWR-core barrel. Analytical integration of the cylindrical shell equations.** Ludwig, A.; Krieg, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp B6/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. B. Thermal and fluid/structure dynamics analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The knowledge of the dynamic behaviour of a PWR-core barrel is an essential prerequisite for reliable assessments of the consequences due to postulated blowdown accidents in PWRs. Therefore as part of the HDR program the core barrel dynamics is investigated both experimentally and theoretically. For this reason the computer code CYLDY3 for the structural dynamics of the core barrel has been developed, which are described in this paper.

583 **Coupled fluid-structure analysis of the core barrel behaviour during blowdown.** Katz, F.; Schlechtendahl, E.G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp B6/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. B. Thermal and fluid/structure dynamics analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The purpose of the work described here is the investigation of the effects of fluid structural coupling on the dynamic behaviour of a PWR core barrel during blowdown. The code STRUYA which is a result of this work is intended to provide a flexible tool for coupled analysis in situations where the fluid flow field can be approximated by a twodimensional region which interacts with a weak structure in the third dimension.

584 **Calculations on the HDR core barrel response during snapback tests.** Ludwig, A.; Schumann, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp B6/7 (1-6) of Structural mechanics in reactor technology. Transactions. Vol. B. Thermal and fluid/structure dynamics analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The HDR experimental program includes a snapback experiment, scheduled for 1979, which will be used for assessment of structural models of the core barrel (a thin cylindrical shell) and its interaction with the surrounding fluid. In the experiments the core-barrel is deflected initially by a concentrated loading and suddenly released. The response will be measured. The loading is imposed by a piston either at the lower ring-stiffened end or at a point in the upper part of the shell. The tests will be made in air and water. The response of the core barrel has been analyzed by means of the codes CYLDY2 (Shell dynamics), FLUX1 (incompressible fluid couple to the structure) and FLUX2 (compressible fluid coupled). Preliminary results for eigenfrequencies, static deflection and dynamic response are reported in this paper. The computed results agree satisfactorily with simple analytical estimates as far as available. Very fine discretization is required for the local shell loading. Here one has to resolve the size of the load area and to account for the inertia of the piston. The mass of the air alters most shell eigenfrequencies by less than 1% except for the lowest breathing mode (27%). Fluid compressibility, nonlinear convective terms and viscosity appear of minor importance.

585 **Plastic instability of Zircaloy cladding submitted to LOCA conditions.** Leridon, A.; Pauwels, C. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. des Reacteurs a Eau). pp C4/2 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

The ballooning of Zircaloy tubes used as fuel cladding in Pressurised Water Reactor has focused attention from many workers with respect to the loss of coolant accident. This paper gives an other approach of the plastic instability criterion of a tube submitted to internal pressure and temperature whatever the rate of variation of both parameters.

586 **Comparison of response spectra for aircraft impact calculated by a beam-mode and a 3D-shell-model.** Krivy, J.; Kuntze, W.M. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). pp J9/6 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. J. Loading conditions and structural analysis of reactor containment. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A three-dimensional finite-element-model of a German PWR-reactor-building is used for calculating appropriate spectra for the design of components against aircraft impact; the spectra of the 3D-shell-model are compared with those of the related lumped-mass-model consisting of beam-elements. Presupposing linear material properties, dynamic calculations of the PWR reactor building were performed with the standard-load-function for aircraft impact used in West-Germany.

587 **Integrated structural design of nuclear power plants for high seismic areas.** Rieck, P.J. (Gilbert Associates, Inc., Reading, PA (USA)). pp K4/2 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. K(a). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A design approach which structurally interconnects NPP buildings to be located in high seismic areas is described. The design evolution of a typical 600 MWe steel cylindrical containment PWR is described as the plant is structurally upgraded for higher seismic requirements, while maintaining the original plant layout. The plant design is presented as having separate reactor building and auxiliary structures for a low seismic area (0.20 g) and is structurally combined at the foundation for location in a higher seismic area (0.30 g). The evolution is completed by a fully integrated design which structurally connects the reactor building and auxiliary structures at superstructure elevations as well as foundation levels for location in very severe seismic risk areas (0.50 g).

588 **Comparison of soil-structure interaction by different ground models.** Takemori, T.; Kuwabara, Y.; Ogiwara, Y.; Suwabe, A. (Taisei Corp., Tokyo (Japan). Engineering and Construction); Tanaka, K. (Kyushu Electric Power Co., Inc., Fukuoka (Japan)). pp K5/5 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. K(a). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In this paper, dynamic soil-structure interaction analyses for P.W.R. power plant facilities are performed, using parameters of Young's moduli, soil dampings and three earthquake waves having different frequency characteristics, by the following two methods: 1. Response analysis of the lumpted mass model with the swaying - rocking springs of soil (SRM). 2. Deconvolution analysis by a F.E.M. model of soil (FEM). Results of these analyses are discussed and the modification of soil damping is proposed to bring the analysed results close to the general observed tendency concerning amplified acceleration around the foundation.

589 **Soil structure interaction analysis by different methods.** Waas, G.; Weber, W. (Hochtief A.G. fuer Hoch- und Tiefbauten, Frankfurt am Main (Germany, F.R.)). pp K6/1 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. K(a). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The paper is a contribution to the continued discussion on appropriate methods for seismic soil-structure interaction analysis. A circular PWR-building is analized using a plane strain finite element model, an axisymmetric finite element model, and a lumped parameter model. The structure weighs 1600 MN, it is about 65 meters high, 60 meters in diameter, and very stiff. It is founded 18 meters below the ground surface on alluvial deposits which are several hundred meters thick.

590 **Seismic response analysis of nuclear power plant auxiliary mechanical equipment.** Lin, C.W. (Westinghouse Electric Corp., Pittsburgh, PA (USA). PWR Systems Div.). pp K11/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Seismic response analysis of nuclear power plant auxiliary mechanical equipment is a vital link to the successful design of the plant in assuring its safe operation either during or after a postulated earthquake. Notwithstanding its importance, this subject has not been treated sufficiently in the literature. In an earlier publication, the author presented some modeling techniques for the analysis of tanks, heat exchangers, valves, and pumps. These modeling techniques have since become the main-stay in the qualification of the auxiliary mechanical equipment. In this paper, the prevailing modeling techniques will be reviewed in accordance with current technological development.

591 **Vibrational characteristics of primary reactor coolant system.** Shiraki, K.; Fujita, K. (Mitsubishi Heavy Industries Ltd., Takasago, Hyogo (Japan). Takasago Technical Inst.); Kitade, K. (Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan). PWR-Plant Design Engineering Dept.); Kawakatsu, T. (Kansai Electric Power Co., Inc., Osaka (Japan). Nuclear Project Dept.). pp K13/8 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

It is exceedingly important from a standpoint of safety to recognize what response may be shown when the primary reactor coolant system, one of the main components of a nuclear power station, suffers from an earthquake. However, since the primary reactor coolant system has complex structure consisting of equipments and pipings with many variations in stiffness or mass distributions, it is necessary to examine thoroughly to find most proper method for modeling.

592 **Seismic response comparisons for an embedded high temperature gas-cooled reactor (HTGR) on a high seismic site.** Schlafer, W. III; Tow, D. (General Atomic Co., San Diego, CA (USA)); Johnson, J.J. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). pp K7/2 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. K(a). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The structure considered in this investigation consists of the Reactor Containment Building (RCB) and Prestressed Concrete Reactor Vessel (PCRV) for a representative HTGR. In the typical HTGR plant configuration, the RCB/PCRV are normally supported on a common base slab on or near the surface of the soil. A general 3-D dynamic model of the surface-founded RCB/PCRV configuration consisting of a lumped-parameter structure supported by a rigid base slab on an elastic half-space was utilized for response calculations for each of five different soil conditions characterized by shear wave velocities of 400-8000 fps. The in-structure reponse spectra were determined for each site condition and combined to form a design envelope which encompasses the entire range of site parameters. The seismic excitation was defined as synthesized earthquake time histories with maximum horizontal ground accelerations of 0.15 g/OBE and 0.30 g/SSE and whose response spectra envelope the design spectra of the U.S. NRC Regulatory Guide 1.60.

593 **Evaluation of seismic movements of a pebble bed reactor core as basis for shaking experiments.** Gloeckner, H.J.; Kemter, F. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)); Schmidt, G. (Hochtemperatur-Reaktorbau G.m.b.H., Juelich (Germany, F.R.)). pp K12/7 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In German)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The behaviour of the pebble bed in the prestressed-concrete vessel of a high-temperature reactor can be determined only inaccurately by model experiments, and the seismic response of the reactor must be known as boundary condition. In the paper, dynamic calculations to determine this response are reported. A method is applied which permits natural, random earthquake time curves to be adapted to a given design system by iterative modification. Preliminary results of seismic experiments are reported.

594 **Seismic interaction effects for steam generators in CANDU 600 MWe nuclear power plants.** Aziz, T.S. (Acres, Inc., Toronto, Ontario (Canada). Structural Mechanics Dept.); Duff, C.G. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Research Community). pp K11/7 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The paper presents a substructuring technique to overcome the difficulties associated with using a coupled model with small modal mass ratios. The technique accounts for interaction effects as well as multiple input motions and provides a clear understanding of the beneficial coupling effects. Typical results using this substructuring technique combined with spectrum analysis for a typical CANDU NPP on a soil site are presented and discussed. Guidance on the validity of the approach to other similar secondary systems applications is given.

595 **Coupled lateral-torsional response of equipment mounted in CANDU nuclear power plants.** Ishac, M.F. (Ontario Hydro, Toronto (Canada). Civil Design Dept.); Heidebrecht, A.C. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Civil Engineering and Engineering Mechanics). pp K11/8 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In this paper, a coupled lateral torsional model (CLTM) is developed as a modification of the uncoupled lateral torsional model (ULTM) by including the torsional degree of freedom for each mass point and taking into consideration the effect of eccentricities between the centers of mass and rigidity at each floor level. The lateral and rotational time-histories at each floor level are characterized by lateral and rotational floor response spectra at the mass centroid. These time-histories are also combined to determine the lateral floor response spectra at the extreme edges of each floor mass.

596 **Forced vibration test of 1/5 scale model of Candu core.** Muto, K. (Muto Inst. of Structural Mechanics, Inc., Tokyo (Japan)); Kuroda, K.; Kasai, Y. (Electric Power Development Co. Ltd., Tokyo (Japan)). pp K12/3 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The CANDU (Canada Deuterium and Uranium) nuclear power reactor system developed in Canada uses heavy water as moderator and natural uranium as fuel. The 600 MWe CANDU core primarily consists of a horizontal cylindrical calandria vessel, a total of 380 fuel channel assemblies and reactivity control mechanisms. The fuel channel assemblies, each of which is made up of calandria tube, pressure tube and fuel elements (hereafter referred to as CT/PT assembly), span the calandria axially on a constant square pitch to form a circular lattice array. In addition the calandria is penetrated by a number of guide tubes for the reactivity mechanisms both in vertical and horizontal directions. Aiming at introducing CANDU into Japan, EPDC (Electric Power Development Co., Ltd.) has undertaken 'CANDU Core Seismic Verification Program' in 1977, which is composed of two stages, STEP I (the test using a 1/5 scale half-cut model of the core) and STEP II (the tests using full scale partial models). This paper deals with the STEP I test results. The test was intended to clarify the basic charcteristics pertinent to the seismic behavior of tube assemblies in water and insertion capability of control shut-off rods during an earthquake. The test model was selected as a half portion of the core and cut vertically so that the actual behavior of the inside components could be visually observed. The tests were conducted using a large shaking table.

597 **Field vibration test results and design for reactor coolant piping systems of ATR 'Fugen'.** Igarashi, T.; Arai, K. (Mitsubishi Atomic Power Industries, Inc., Omiya, Saitama (Japan). Nuclear Development Center); Fujita, K. (Mitsubishi Heavy Industries Ltd., Takasago, Hyogo (Japan). Takasago Technical Inst.). pp K13/7 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. K(b). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publsihing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In most Japanese Nuclear Power Plants, the field vibration test on the important piping systems has been performed to verify the appropirateness of the seismic design and the integrity of the pipe work. For a prototype Heavy-Water Reactor 'FUGEN' (165-MWe heavy-water-moderated, boiling light-water-cooled pressure tube reactor, developed along one of the Japan's national projects, and reached criticality on March, 1978), the reactor coolant piping systems are connected with the pressure tube, the steam drums and

the recirculation pumps. The steam drums are set in the top level and the recirculation pumps in the bottom level. This layout is complicated in comparing with other type of Reactors. The seismic analysis of the main piping systems in the FUGEN was performed by means of the model analysis method using the floor response spectrum.

598 **Dynamic plastic buckling of shells. A reconsideration of the Vaughan-Florence analysis.** Horvay, G.; Stockton, F.D. (Massachusetts Univ., Amherst (USA). Dept. of Civil Engineering); Veluswami, M.A. (Indian Inst. of Tech., Madras. Engineering Design Centre). pp L4/8 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In the evaluation of Loss-Of-Coolant-Accidents (LOCA) in a nuclear reactor the necessity of considering collapse of a cylindrical shell due to radial impulse load (uniform in the axial (x) and peripheral (theta) directions) of such magnitude that it takes the shell instanteneously into the plastic regime has been recognized some 15 years ago (pioneered by J. N. Goodier, and a Stanford Research Institute group under G.R. Abrahamson). The most illuminating presentation of the problem was given by H. Vaughan and A. Florence in 1970. They determined the buckling mode n and the amplification factor A of the initial imperfection (represented by a sine series in the theta direction). VF solved their problem by neglecting an elastic restoring term $\Omega^2$ in the governing membrane equation (the Esub(h) term in their equation (19)); this greatly simplified solution of the subsequent bending equation. They could do this because of the presence of a forcing term 1/tausub(f) in the equation which also acted as a restoring force.

599 **Creep collapse of a cylindrical shell subjected to external pressure at high temperature.** Nagato, K.; Takikawa, N. (Kawasaki Heavy Industries Ltd., Tokyo (Japan). Nuclear Power Engineering Dept.). pp L8/1 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The purpose of this paper is to qualify (1) the various methods of analysis proposed in the past for the prediction of creep collapse time of a cylindrical shell subjected to external pressures at high temperatures and (2) 'C-BUCKL', a computer program for the analysis written by the present authors. The qualification is based on the comparison of theoretical analyses and test results. Much care was taken to use test tubes more closely identified than the ones used in any preceding similar test.

600 **Unconventional dynamic behaviour of thin spherical containment shells. A semi-analytical description.** Goeller, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp B8/3 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. B. Thermal and fluid/structure dynamics analysis. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The condensation of steam, blown into the water pool of the pressure suppression system of a boiling water reactor (BWR) causes pressure oscillations, which act upon the walls of the pool. For certain BWR's some of these walls are parts of the spherical reactor containment. As they are rather flexible, thin shells, the pressure oscillations may induce significant transient deformations of the containment. Using a finite element program for the structural investigation, no satisfactory agreement with experimental findings was achieved. Thus, a more detailed investigation of the spherical containment structure was carried through, which will be presented here. A preliminary analysis of the static behaviour of thin shells according to Fluegge shows, that the shell deflections due to transverse loadings decay very rapidly with growing distance from the loaded region. For typical BWR containments this means, that in a distance of about 5 degrees the transverse reactions are reduced to a remainder of only 5%. Consequently, an appropriate numerical description of such a shell must be based on a relative fine resolution which could not be met with the above mentioned finite element calculation. In order to get a more precise insight into the dynamics of thin spherical shells a detailed semi-analytical model was developed. It is based on Fluegge's shell theory, which was modified for translatory inertia forces. Modes and eigenfrequencies are computed, then the deformations of the shell under arbitrary pressure loadings are determined by modal superposition.

601 **Proceedings of the second US-Japan seminar on HTGR safety technology, 1. General; accident delineation; helium technology.** Tokai, Ibaraki; JAERI (1979). vp. (CONF-781144—(Vol.1)).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

Separate abstracts are presented for each of the conference papers included in the data base.

602 **Proceedings of the second US-Japan seminar on HTGR safety technology, 1. Material properties and design methods; seismic research.** Tokai, Ibaraki; JAERI (1979). Vp. (CONF-781144—(Vol.2)).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

Separate abstracts are presented for each of the conference papers included in the data base.

603 **Safety design.** Jeppesen, R.; Milicev, M. (Ontario Hydro, Toronto (Canada)). pp vp of Proceedings of the symposium on CANDU reactor safety design. Toronto, Ontario, Canada; Canadian Nuclear Association (1978).

From Symposium on CANDU reactor safety design; Toronto, Canada (Nov 1978).

The principal concern associated with the use of nuclear energy for the production of electrical power is the accumulation of radioactive material within the reactor fuel. Early recognition of the risks associated with the operation of nuclear generating stations led to an integrated design approach to provide a high level of public protection against those risks. Many barriers to the release of radioactivity are provided, some inherent in the design, others specially provided. A multi-level defense-in-depth design acts to protect these barriers under steady state operating conditions and during a wide range of transients. This overall safety design approach, including the special safety features, has led to an excellent safety record in operating nuclear generating stations. The design approach adopted also leads to a good deal of confidence that risk due to these stations can be maintained at a very low level.

604 **Protection from common-mode events.** Webb, J.R. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Power Projects). pp vp of Proceedings of the symposium on CANDU reactor safety design. Toronto, Ontario, Canada; Canadian Nuclear Association (1978).

From Symposium on CANDU reactor safety design; Toronto, Canada (Nov 1978).

As part of the defence-in-depth for the safety of nuclear power plants, protection from common-mode events is provided. This paper reviews the credible common-mode events considered for the CANDU nuclear power plants and describes the protective measures applied. By use of specific examples, the conclusion is reached that all credible random and common-mode events can be accommodated by the design of CANDU power stations currently under construction.

605 **Evaluation of design pressure for the F.B.T.R. secondary sodium heat transfer system and its components in case of a leak in steam generator.** Rajput, A.K. (Reactor Research Centre, Kalpakkam (India)). pp 915-924 of Proceedings of fourth national heat and mass transfer conference 1977 [held at Roorkee]. Meerut, India; Sarita Prakashan (1977).

From 4. national heat and mass transfer conference; Roorkee, India (21 Nov 1977).

Present paper aims at analysing the thermo-hydraulic phenomenon of sodium-water or sodium-steam reaction, and consequent build up of pressures in sodium at various points of the secondary heat transfer system of F.B.T.R. This is necessary to check the design of various equipments in the system for these worst conditions. Thermo-hydraulic equations describing pressure, temperature and adiabatic growth rate of hydrogen bubble (formed as result of sodium-water reaction) are solved simultaneously with equations governing the leak rate of steam or water. A Runga Kutta method of fifth order has been used. Subsequent to a leak in super heater portion, leak rate of steam is found by "Fano-flow" analysis of steam flowing in the ruptured tube. On the other hand leak rate of water, in case of rupture in evaporator portion, is analysed by an inertia controlled model. Pressure/flow transients, in the rest of heat transfer loop and its components, are evaluated by the simultaneous solution of quasi-hyperbolic partial differential equations of momentum and continuity balance. Solution is effected by the method of characteristics. A computer program in FORTRAN-IV is operational for handling the above problem.

# 25 ENERGY STORAGE

## 2509 Batteries

*REFER ALSO TO CITATION(S) 639*

606 **(NASA-CASE-LEW—12918-1) Toroidal cell and battery.** Nagle, W.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Apr 1981. 7p. Avail: US Patent and Trademark Office.

A toroidal storage battery designed to handle relatively high amp-hour loads is described. The cell includes a wound core disposed within a pair of toroidal channel shaped electrodes spaced apart by nylon insulator. The shape of the case electrodes of this toroidal cell allows a first planar doughnut shaped surface and the inner cylindrical case wall to be used as a first electrode and a second planar doughnut shaped surface and the outer cylindrical case wall to be used as a second electrode. Connectors may be used to stack two or more toroidal cells together by connecting substantially the entire surface area of the first electrode of a first cell to substantially the entire surface area of the second electrode of a second cell. The central cavity of each toroidal cell may be used as a conduit for pumping a fluid through the toroidal cell to thereby cool the cell. Official Gazette of the U.S. Patent and Trademark Office

607 **All-solid lithium electrodes with mixed-conductor matrix.** Boukamp, B.A.; Lesh, G.C.; Huggins, R.A. (Stanford Univ, Calif). *Journal of the Electrochemical Society;* **128**: No. 4, 725-729(Apr 1981).

The concept of a novel all-solid composite electrode is presented. One example of such a composite contains a finely dispersed reactant, Li/sub y/Si, in a solid mixed-conducting matrix, Li/sub 2.6/Sn. Repeated charging and discharging of such electrodes without appreciable loss of capacity has been demonstrated. The polarization is found to be comparable to values typical of highly porous electrode systems in molten salt electrolytes. 22 refs.

608 **Reactions of FeS electrodes in LiCl-KCl electrolyte.** Tomczuk, Z.; Preto, S.K.; Roche, M.F. (Argonne Natl Lab, Ill). *Journal of the Electrochemical Society;* **128**: No. 4, 760-772(Apr 1981).

The reactions of FeS electrodes in LiCl-KCl electrolytes of various compositions were determined by a combination of phase studies, cyclic voltammetry, and emf measurements. The effect of temperature, charge-cutoff voltage, and electrolyte composition on the phases present in the sulfide electrode were determined. Six electrochemical and four chemical reactions can occur. The emf's of three of the six electrochemical rections were measured over a temperature range of 380°-530°C and were computed for the other three electrochemical reactions. The free energy changes for the chemical reactions are also calculated. This work is pertinent to high-performance batteries for use on vehicle propulsion and energy storage. 29 refs.

609 **Mathematical modeling of the lithium-aluminum, iron sulfide battery. 1. Galvanostatic discharge behavior.** Pollard, R.; Newman, J. (Univ of Calif, Berkeley). *Journal of the Electrochemical Society;* **128**: No. 3, 491-502(Mar 1981).

A mathematical model of the LiAl/LiCl, KCl/FeS high temperature battery is presented. The model considers a whole prismatic cell which consists of negative electrode, separator, electrolyte reservoir, and positive electrode. Physical phenomena described are ohmic potential drop and diffusion potential in the electrolyte, changes in porosity and electrolyte composition due to electrochemical reactions, local reaction rates, and diffusion, convection, and migration of electrolyte. In addition, the analysis includes finite matrix conductivities, variable physical properties, and the possibility of specific simultaneous reactions in the positive electrode. The results show many of the trends in behavior observed experimentally. 10 refs.

610 **Mathematical modeling of the lithium-aluminum, iron sulfide battery. 2. The influence of relaxation time on the charging characteristics.** Pollard, R.; Newman, J. (Univ of Calif, Berkeley). *Journal of the Electrochemical Society;* **128**: No. 3, 503-507(Mar 1981).

A mathematical model of the LiAl/LiCl, KCl/FeS cell has been used to study the behavior of the system during relaxation and charging. The effects of state of charge, cell temperature, and current density are presented, and the influence of a period of relaxation on the subsequent charging operation is investigated. In addition, factors that can have a significant impact on the charging characteristics are identified. 10 refs.

# 29 ENERGY PLANNING AND POLICY

## 2902 Economics And Sociology

*REFER ALSO TO CITATION(S) 636*

611 **Total costs of energy services.** Reister, D.B.; Devine, W.D. Jr. (Oak Ridge Assoc Univ, Tenn). *Energy (Oxford);* **6**: No. 4, 305-315(Apr 1981).

An energy service may be defined as a measure of the service actually provided to ultimate consumers by their own use of energy, quantified, for example, by using units of work or of heat at various temperatures. This paper presents estimates of total costs of 15 energy services for the year 1972. These costs include the cost of producing and distributing commercial forms of energy, the cost of the equipment that utilizes this energy in providing services, and the cost of operating and maintaining the end-use equipment. The overall cost of energy service in 1972 is estimated to be nearly $400 billion, a figure equal in magnitude to about one-third of the 1972 gross national product. Categories of energy services are identified in which major technological changes in the manner of providing the service might make the greatest difference in the overall cost of energy service. 4 refs.

## 2903 Environment, Health, And Safety

*REFER ALSO TO CITATION(S) 178, 179, 180, 181, 982, 1000*

## 2904 Natural Resources

*REFER ALSO TO CITATION(S) 61, 63, 1129, 1131*

## 2906 Nuclear Energy

*REFER ALSO TO CITATION(S) 61, 62, 63, 178, 181, 182, 185, 189, 226, 241, 396, 566*

612 (INIS-mf—6447, pp vp) **Archipelago of nuclear material export licensing.** Wright Harmon, D. (Edlow International Co., Washington, DC (USA)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

613 **(NP—2900890) Low-level radioactive waste management: charting state issues and responsibilities.** Colby, J. (State Planning Council on Radioactive Waste Management, Washington, DC (USA)). Jul 1981. 43p. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585. Order Number DE82900890.

This guide has offered states a detailed outline for managing low-level wastes as directed by the National LLW Policy Act. A survey of generators and their output, consensus formation with major actors and the establishment of a state waste management committee have been offered as a design for an LLW program. Independent and cooperative options were discussed, and a strategy for interstate action was proposed. It is hoped that this guide will foster increased efforts by states to develop permanent solutions to the LLW problem as they are authorized to do by the National Low-Level Radioactive Waste Policy Act.

614 **Risk and response.** Warner, F. (Cremer and Warner (UK)). pp 228-234 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

A discussion of nuclear power and public acceptability can quite properly begin with a general consideration of the nature of response to risk. Response follows perception, and builds up from the individual through group response to the judgement of society expressed in governmental decisions on what is acceptable. Various types of risk, and public reaction, are discussed.

615 **Swedish nuclear referendum 1980.** Zetterberg, H.L. (Swedish Institute of Opinion Research). pp 245-274 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

A referendum is a multi-faceted phenomenon. It concerns people's attitudes, and as such can only be understood in terms of the general process of value development in a national culture. It is also a political event which can only be understood as part of the political process within a nation. Finally, these processes interact during a referendum campaign, so that the resulting vote of the electorate must be seen as part of the ongoing process of the formation of public opinion. This paper examines these three processes, not only with a view to explaining the outcome of the referendum, but also in the hope of obtaining a better understanding of the nature of the processes themselves.

616 **Nuclear energy controversy in Austria. A sociological problem.** Oszuszky, F.; Szeless, A. (Austrian Electricity Board). pp 275-279 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

The sociological aspects of the energy issue have become of overwhelming importance in the last few years. As a result, traditional considerations such as the importance of adequate and cheap energy supplies as the basis for growth, and the necessity, in a time of politically uncertain oil supplies, of energy supply security and diversity, have been equalled in importance, and sometimes replaced, by arguments about the social goals to be achieved. Nuclear energy has been selected as the vehicle for a socio-political debate on the controversial issue of the application of large-scale technology. Beyond that it has acquired a symbolic role in what is really an emotional attack on the political systems, economy and culture of present day civilization. It stands for the concentration of power, the centralization of technology and society, and man's dependence on the products of that centralization. Nuclear power is seen as one of the motors of further economic growth and thus an apparent pioneer of the further destruction of our natural and social environment.

617 **Public attitudes towards the nuclear industry in Canada.** Aspin, N. (Canadian Nuclear Association, Toronto, Ontario). pp 280-290 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

To understand attitudes to nuclear power in any country, it is necessary to examine them in the perspective of the overall economic and political environment of that country and, more particularly, its energy supply and demand characteristics. This paper, therefore, begins by examining briefly these aspects of Canada. The discussion continues under the following headings: Canada's nuclear development and the challenges to it; public inquiries into nuclear energy; the media and nuclear power; level of public acceptance of nuclear power in Canada; conclusions.

618 **Roessing, a case history of economic and social benefits from uranium mining.** Walker, R.S. (Rio Tinto Zinc Corp. Ltd.). pp 291-296 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

During the last two decades, the image of the nuclear industry, projected by much of the media throughout the western world, has moved from a heroic role to that of a regrettable and unnecessary danger to humanity in general. Instead of being regarded as outstanding pioneers of technological freedom, we, the producers of uranium for electricity generation, are condemned as greedy and unprincipled exploiters who force a new and undesirable industrial process on an unwilling public who do not even require it. This outcry seems to increase in intensity the more developed and the richer the country concerned happens to be. Conversely, the poorer the country, the less one hears from within its borders of the evils and dangers of uranium mining and nuclear reaction. Namibia is a poor underdeveloped country which now contains the largest uranium mine in the world. I want to try to explain what the development of that mine - Roessing - has done for South West Africa/Namibia.

619 **Taking stock after INFCE.** Grey, A.J. (Pancontinental Mining Ltd., Sydney (Australia)). pp 301-309 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

No one seriously doubts the desirability of achieving an effective means to limit the proliferation of nuclear weapons; the quest is to find an acceptable balance between security of energy supply and optimal non-proliferation methods. In the context of the search for this balance, it is appropriate to examine the findings of the International Nuclear Fuel Cycle Evaluation (INFCE) study released in February 1980, and to review where the international safeguards regime stands today, for so long as there is fear of nuclear weapons, the uranium industry will be affected by efforts of governments to limit nuclear proliferation. INFCE was a joint study by 66 nations and five intergovernmental organizations to consider the possibility that nuclear fuel cycle materials or technology might be misused for the purpose of constructing nuclear weapons and to consider if any technical, institutional or improved safeguards measures might be introduced to discourage this undesirable eventuality.

620 **Non-proliferation. A political problem.** Manley, I.T. (Department of Energy, London (UK)). pp 310-317 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

Proliferation is a problem that can only be solved when the political problems which lead countries to contemplate the posses-

sion of nuclear weapons are solved; in the meantime it can only be managed. Non-proliferation policy has to deal both with the political and the technical aspects of proliferation. It must seek to buy time by addressing the reasons why nations feel the political need to construct nuclear weapons, as well as delaying the moment when such nations feel capable of doing so. The subject is examined and proposals made.

621 **International nuclear trade and non-proliferation issues. Some Canadian views.** Campbell, D.W. (Canadian Dept. of External Affairs. International Energy Policy Division). pp 318-323 of Uranium and nuclear energy 1980. Proceedings of the fifth international symposium held by the Uranium Institute, London, 2-4 September, 1980. Guildford, England; Westbury House (1981).

From 5. international symposium on uranium and nuclear energy; London, UK (2 Sep 1980).

Canada, as a major exporter of nuclear material and technology, has played and intends to continue to play a significant role in that field. The concerns of the Canadian Government are essentially two. First, what can the Canadian Government do to assist and facilitate the marketing efforts of Canada's nuclear industry. Secondly, how can the Canadian Government best assure the Canadian people that Canada's nuclear exports, whether of nuclear material or of nuclear reactors, will not contribute to nuclear proliferation. Since there are others here who can speak more knowledgeably than I on the first point, I will concentrate on the second.

622 **Study on the future nuclear power development strategy in Korea.** Juhn, P.E. (Korea Atomic Energy Research Inst., Seoul (Republic of Korea)). pp 773-778 of Proceedings of Korea symposium on science and technology. Seoul, Korea; Korean Federation of Scientific and Technological Societies (1980).

From 7. Korea symposium on science and technology; Seoul, Republic of Korea (13 Jul 1979).

The future energy demand has been forecasted by demand sectors and by supply sources, mainly as a function of GNP growth by using the multi-regressional method. It is assumed that the nuclear power will be the major power generation source in Korea, supplying more than 20 % of total energy demand by the year 2000, regardless of future GNP growth rates. The installed capacity of nuclear power plants will reach from current 7 % (600 MWe) to over 34 % (11,000 - 17,000 MWe) and 60 % (30,000 - 48,000 MWe) by 1991 and 2000, respectively. For low economic growth 13 and 31 nuclear units are predicted for operation by 1991 and 2000, respectively, while 18 and 44 units are predicted for high growth. The alternative reactor scenarios for both low and high nuclear power growth have been analyzed in respect to total nuclear investment costs, availability of fuel cycles, nuclear safety features, and domestic manufacturing and engineering capabilities. Two types of thermal reactors (i.e. PWR and CANDU-HWR), which are currently being introduced into Korea, and the plutonium-cycle LMFBR are being considered as reactor candidates in this strategic analysis. Introduction of the commercial FBR is assumed only when enough fissionable material for core loading is available from domestic nuclear spent fuel. CANDU spent fuel is not considered for recycling before 2000. As a result of the study, recommendations for future nuclear policy on reactor strategy along with nuclear fuel cycles, manpower and technology development have been made.

623 **Advantages presented by the industrial introduction of information processing in the centralised surveillance of radiation levels.** Vialettes, H.; Leblanc, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). pp 759-762 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980). (In French)

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Data processing and on-line systems are described for the centralised control of monitoring radiation levels in nuclear industry. The application of these techniques in a study concerning 120 ways of ensuring effective monitoring of a plant preparing radionuclides for CEN-SACLAY is discussed. This included 62 ways of controlling contamination of the air by aerosols, 54 ways of controlling external irradiation and 4 ways of controlling contamination of the air by gases. The improvements in monitoring gained by using such a system and the flexibility of the system are outlined.

624 **Inquiries into nuclear energy.** Wyatt, A. (Canatom Ltd., Montreal, Quebec (Canada)). pp 54-86 of 20. annual international conference. Toronto, Ontario; Canadian Nuclear Association (1980).

From Annual conference of the Canadian Nuclear Society; Montreal, Quebec, Canada (18 Jun 1980).

The different types of inquiry into nuclear power are discussed. Twelve different inquiries, seven in Canada, two in New Zealand, two in Britain, and one in Australia, are summarized, and the costs of many of the hearings given. The role of the media is then reviewed, and finally there is a discussion of the perennial problem for inquiries, the different expectations of different groups as to the purpose and outcome of the inquiry. In the conclusions some personal observations on the preferred form of inquiry are offered.

625 **Trends in public opinion. The national scene.** Barrados, M. (Atomic Energy of Canada Ltd., Ottawa, Ontario). pp 87-100 of 20. annual international conference. Toronto, Ontario; Canadian Nuclear Association (1980).

From Annual conference of the Canadian Nuclear Society; Montreal, Quebec, Canada (18 Jun 1980).

A brief overview of Canadian public opinion on the use of nuclear power to generate electricity is presented. The findings from several different studies have been brought together to evaluate overall trends and describe some of the factors that have been found to be associated with these trends. In particular, different measures or different questions used in these public opinion studies are examined. These differences will be described and assessed to arrive at an overall evaluation by the Canadian public of the use of nuclear power.

626 **Trends in public opinion. . The Ontario case.** Douglin, J.J. (Ontario Hydro, Toronto (Canada)). pp 101-117 of 20. annual international conference. Toronto, Ontario; Canadian Nuclear Association (1980).

From Annual conference of the Canadian Nuclear Society; Montreal, Quebec, Canada (18 Jun 1980).

A case study of public opinion in Ontario relative to nuclear power is offered. The arguments of supporters and opponents are reviewed, and the implications of studies into public perception for nuclear communications are explored. The data was gathered in Ontario over the past five years, particularly by the Gallup Omnibus studies and in a survey carried out for Ontario Hydro. Concerns about the environment and safety, energy issues, cost and need seem most closely related to the perception of nuclear power.

## 2910 Conservation

*REFER ALSO TO CITATION(S) 637*

627 **(GPO—65-855) Oversight: DOE solar and conservation programs.** (Committee on Science and Technology (U.S. Congress. House), Washington, DC Subcommittee on Energy Research, Development and Demonstration (Fossil Fuels)). 1980. 213p. Avail: Subcommittee on Energy Development and Applications.

The research management in the programs was examined. The allocation of Federal funds was investigated with respect to the total expenditures for solar/conservation vs. fossil fuels development. Charts are presented which show decreases in the fraction of the budget for the programs. Program goals were defined and recommendations for added private sector involvement are made.

## 2920 Supply, Demand, And Forecasting

*REFER ALSO TO CITATION(S) 611*

628 **(P—300-80-033) California energy futures: a presentation made to the California Energy Commission.** (SRI International, Menlo Park, CA (USA)). Nov 1980. 57p. California Energy Commission, Sacramento, CA. Order Number DE82900406.

A study was performed to study various long term energy future for California. It analyzed types of changes in California residents' consumption habits and living patterns that occurred in the 1970s and then projected the energy consequences of those trends. A summary of the results was presented at the California Energy Commission meeting and a reprint of the transcript is presented in this report.

## 2930 Policy, Legislation, And Regulation

*REFER ALSO TO CITATION(S) 182*

629 **(PUBL—96-145) Pacific basin energy.** (Committee on Energy and Natural Resources (U.S. Senate), Washington, DC). 1980. 551p. Avail: Committee on Energy and Natural Resources.

Testimony is presented concerning pending legislation which provides for the assessment and development of the potential for renewable energy sources in the U.S. insular areas, including the trust territories. Options for self-sufficiency throughout the Pacific basin are considered in light of rapidly escalating fuel costs.

630 **Flexibility in radiation protection legislation. The UK approach.** Beaver, P.F.; Gill, J.R. (Health and Safety Executive, London (UK)). pp 983-986 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The UK approach to radiation protection legislation is described in detail. The advantages are outlined of a flexible approach whereby the objectives of the legislation are clearly identified but the means of achieving these are left open or qualified by terms such as 'where reasonably practicable'. The roles and viewpoints of management and unions in such an approach are discussed especially with respect to legislation such as the Health and Safety at Work Act. Specific topics include requirements for notification of use, criteria for controlled areas and the tasks of the radiation protection adviser.

631 **Review from the regulatory position of the control of occupational exposure associated with the first 20 years of the United Kingdom commercial nuclear power programme.** Emmerson, B.W. (Health and Safety Executive, Liverpool (UK). Nuclear Installations Inspectorate). pp 987-990 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Experience gained by the Nuclear Installations Inspectorate (NII) during the past 20 years in the regulatory control of the nuclear power programme is discussed. After discussing control objectives, the principle sources of occupational exposure associated with the nuclear power programme are tabulated from 1962 to 1979. The fuel reprocessing plants give rise to the highest contribution to radiation dose. It is concluded that there is an improving trend in the radiological exposure pattern despite increasing power generation, fuel burn-up and processing plant throughput. The objective of ensuring that individuals do not exceed the statutory dose limits has largely been achieved. However, optimization procedures will probably be used in the future to optimise procedures and thus exposure data for various tasks will be required.

632 **Occupational radiation protection legislation in Israel.** Tadmor, J.; Schlesinger, T. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Donagi, A. (Tel Aviv Univ. (Israel)); Lemesch, C. (Ministry of Labour and Social Affairs, Jerusalem (Israel)). pp 991-993 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A committee of experts appointed by the Minister of Labour and Social Affairs has proposed a comprehensive draft regulation, concerning the legal aspects of occupational radiation protection in Israel. The first section of the proposed regulation sets forth guidelines for control in facilities where workers handle radioactive materials or radiation equipment. This includes the duties of the managers of such places to ensure adequate radiation protection and also the maximum recommended doses (whole body and individual organs) for radiation workers. The second section deals with the monitoring regulations for radiation workers who may be exposed to doses in excess of 500 mRem/y. The third section outlines the nature of the mechanical supervision required, i.e. routine and special examinations. Finally the committee also proposed six miscellaneous recommendations for radiation protection.

## 2940 Fossil Fuels

*REFER ALSO TO CITATION(S) 999*

633 **Fossil energy research and development in ERDA.** White, P.C. (Energy Research and Development Administration, Washington, DC). pp 115-128 of Energy from fossil fuels & geothermal energy. Progress in energy and combustion science: Volume 2. Chigier, N.A. (ed.). Oxford, England; Pergamon Press Ltd. (1978).

I would like to note in conclusion that the US ERDA Fossil Energy Program currently has over 271 contracts outstanding with the total value of nearly $567 million. We hope to maintain the present standard for cooperative joint funding which anticipates one-third private and two-thirds federal funding for pilot plants and 50/50 funding for demonstration plants. Our participants include many aspects of American industry; oil and gas companies, chemical companies, coal companies, architect engineer and manufacturing companies, utilities, universities, research centers and trade associations. In addition to the contractors performing the major project work, we have contractors performing engineering evaluations, systems studies, planning studies and environmental analyses. We have several inter-agency agreements. We have international agreements with the United Kingdom, Russia, Poland and Germany. We are constantly advised of work in the private sector and adjust our planning accordingly. We cooperate with both the American industry and utilities through the American Gas Association and Electric Power Research Institute to develop national plans which integrate privately sponsored and federally sponsored research and development.

## 2990 Unconventional Sources And Power Generation

*REFER ALSO TO CITATION(S) 627*

# 30 DIRECT ENERGY CONVERSION

## 3001 Mhd Generators

634 **Electron and positive-ion measurements in MHD combustion plasmas with phosphorous addition.** Annen, K.D.; Kuzmenko, P.J.; Keating, R.; Self, S.A. (Stanford Univ, Calif). *Journal of Energy;* **5**: No. 1, 31-38(Jan-Feb 1981).

Simultaneous measurements of the electron concentration by submillimeter interferometry and of the positive ion concentration by a swept electric probe have been made in an ethanol-fueled, potassium-seeded combustion plasma. Phosphorous was added to the reactants to match the maximum phosphorous concentration anticipated in coal-fired MHD plasmas. The electric probe was calibrat-

ed against the interferometer to check the probe theory; it is concluded that because of theory limitations the absolute accuracy of the probe is no better than 50%. However, the discrepancy is systematic over the range of interest to MHD, enabling the probe to provide reliable relative measurements having good temporal and spatial resolution. 20 refs.

### 3005 Fuel Cells

635 **Comparison between flow-through and flow-by porous electrodes for redox energy storage.** Trainham, J.A.; Newman, J. (Univ of Calif, Berkeley). *Electrochimica Acta;* **26**: No. 4, 455-469(Apr 1981).

An economic comparison is made between electrode configurations for flow redox battery applications: (I) the flow-through configuration (current parallel to the fluid flow) and (II) the flow-by configuration (current perpendicular to the fluid flow). Steady-state computer models are developed for each electrode system. These models are used to predict current density, cell voltage, and power density over a complete cycle (charge and discharge). The economic comparison is made by optimizing each configuration with respect to an objective function appropriate for redox battery applications. Only the variable costs are considered. The results of the optimization show that the flow-by configuration is superior. The flow-through configuration not only yields a lower return on investment, but it is impractical due to a requirement of extremely low flow rates ($Re < 0.001$). Its failure is due to current flow (and ohmic potential drop) in the same direction as the fluid flow. 28 refs.

## 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

### 3201 Buildings

636 (PAS—349, pp 11-16) **High cost of heat: a new threat to city neighborhoods.** Kramer, E.; Berger, L. Apr 1980. American Planning Association, 1313 E. 60th Street, Chicago, IL 60637. Order Number DE81904157.

In Energy in the cities symposium.

The threat of the energy crunch to city neighborhoods in the short term is discussed. The problem lies in the high cost of heating, older, unweatherized housing. It has been calculated that the unweatherized conditions of homes of lower income families in the central city results in their paying about 50% more than the regional average for energy. This impact on lower income families results in less purchasing power for other consumer goods. This monetary drain means, then, less tax revenue generated for a city. In renter-occupied housing, energy conservation is difficult to achieve. If the landlord pays the utility bill, the occupant has no concern for conservation; if the occupant pays the utility bill, the landlord has little concern for making the housing unit more energy efficient. When escalating fuel costs are combined with an older housing stock, lower income residents, and a significant number of rental units, the threat of increased housing abandonment arises. The experiences of housing abandonment in Rochester, New York, is discussed. The Federal weatherization program for low income groups and the Canadian governments' grant program for insulation of homes and apartment buildings (built before 1961) are briefly described. (MCW)

637 (PAS—349, pp 23-30) **Adoption of energy conservation features in new homes: current practices and proposed policies.** Kaiser, E.J.; Marsden, M.E.; Burby, R.J. Apr 1980. American Planning Association, 1313 E. 60th Street, Chicago, IL 60637. Order Number DE81904157.

In Energy in the cities symposium.

An examination was made of consumer and builder energy conservation behavior and intentions and a variety of policies to make energy conservation potential a reality in the residential sector was proposed. Parallel surveys of statewide random samples of households and home builders in North Carolina were made. Data were obtained from existing home owners on the use of insulation, weatherstripping, caulking, storm windows, double-paned glass, storm doors, and heat pumps. None of the households used any alternative energy source. The survey of the builders (for 1978) showed they featured sizing of heating/cooling systems to match closely but not exceed design loads and energy-efficient heat pumps in their houses. Approaches taken by the builders to improve the thermal performance of the house included incorporating storm or double-glazed windows, using a square or rectangular shape, adopting insulated ceiling access, and limiting the glass area to ten percent or less. Few were employing solar features, using reflectve glass, or insulated shutters. Future home buyers were surveyed to determine the extent of their interest in energy-efficient design of houses. Eighty-seven percent said they would examine the house for energy-efficient features. (MCW)

### 3203 Industry And Agriculture

*REFER ALSO TO CITATION(S) 1126*

### 3206 Municipalities And Community Systems

*REFER ALSO TO CITATION(S) 905*

638 **(NYSERDA—81-6) Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge.** Arbo, J.C.; Glaser, D.P.; Lipowicz, M.A.; Schulz, R.B.; Spencer, J.L. (Dynecology, Inc., Harrison, NY (USA)). Apr 1981. 50p. New York State Energy Research and Development Authority, Albany, NY. Order Number DE81904186.

This report presents the findings and recommendations of a research investigation designed to adapt the Simplex coal and biomass gasification process to the codisposal of municipal solid waste (MSW) and dewatered sewage sludge (DSS). The rationale of the Phase I study was to delimit and optimize briquette formulation parameters and to set experimental targets for the Phase II process optimization study that will lead directly to the pilot plant demonstration of the Simplex S process in large scale Simplex gasifier facilities. The Phase I program attained its experimental objectives in that it identified a practical range of briquette formulation parameters that permit the production of sturdy briquettes while incorporating fractions of DSS along with MSW and coal. These preferred formulations, which were developed after testing 225 experimental compositions, retain their structural integrity in all zones of the gasifier, do not cake or agglomerate in the pyrolysis and coking zone, and can stand prolonged storage without fungal growth. The operable ratio of coal to waste is from 1:1 to 2:1. The acceptable moisture content in the finished briquette ranges from 12 to 19%. Sound briquettes were produced from DSS containing 20% solids, provided the ratio of RDF (refuse-derived fuel) to DSS is above 8. When employing DSS with a solids content of 40%, the ratio of RDF to DSS may be as low as 4.The critical determinant is the moisture content in the pressed briquette which must be attained without expressing excess water. Recommendations are provided for the Phase II process optimization study that has for its principal goal the production of sturdy, non-caking sludge-freighted briquettes on commercial briquette fabrication equipment.

## 33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

### 3303 Electric-powered Systems

*REFER ALSO TO CITATION(S) 608*

639 **Dissolution and passivation of zinc in concentrated aqueous hydroxide.** McKubre, M.C.H.; MacDonald, D.D. (stanford Res Inst Int, Menlo Park, Calif). *Journal of the Electrochemical Society;* **128**: No. 3, 524-530(Mar 1981).

The rotating ring-disk electrode has been applied in this study to the related phenomena of dissolution, current oscillation, and passivation of zinc in concentrated aqueous NaOH. The results of potentiostatic and potentiodynamic experiments are compared with those of previous workers, and a physical model is proposed is

proposed to describe the anodic behavior of zinc in four successive potential regions: active dissolution, prepassivation, pseudopassivation, and true passivation. This work is pertinent to batteries used in electric vehicular applications. 50 refs.

# 36 MATERIALS

*REFER ALSO TO CITATION(S) 261, 1428*

640 **Mechanical behavior of materials.** Miller, K.J.; Smith, R.F. (eds.). Oxford, England; Pergamon (1980). vp. (CONF-790820—(Vol.2)).

From 3. international conference on mechanical behaviour of materials; Cambridge, UK (20 Aug 1979).

Separate abstracte are presented for each of the conference papers included in the data base.

641 **Introduction to the role of crystal defects in solar materials.** Murr, L.E.; Inal, O.T. (New Mexico Institute of Mining and Technology, Socorro, NM). pp 53-92 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Crystal lattice structures are described and order-disorder phenomena are described in basic terms. The point, linear, and planar lattice defects are described, including grain boundaries and phase boundaries and interfaces, and volume defects are described. In describing crystal defects and illustrating their influence on the structure and properties of solar materials, some instrumentation techniques are illustrated with regard to the direct observation of crystal defects, the range of lattice order or disorder, and related microstructural phenomena. (LEW)

642 **Surface and interface studies and the stability of solid solar energy materials.** Czanderna, A.W. (Solar Energy Research Institute, Golden, CO). pp 93-147 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

After introductory comments are made to provide a general perspective of the problems, an overview of surface and interface studies that are immediately applicable to solar energy technologies are presented. Methods are discussed of deducing surface areas, porosity, structure, topography, surface composition or purity, surface thermodynamics equilibrium shape, diffusion, and adsorption at gas/solid and liquid/solid interfaces. A number of representative problems in solar materials research are discussed briefly. Recent results are given of oxidative degradation of isotactic polypropylene on copper oxide surfaces resulting from the catalytic effect of copper ions to serve as a detailed example of problems caused by incompatibility of two materials. (LEW)

## 3601 Metals And Alloys

*REFER ALSO TO CITATION(S) 211, 217, 217, 265, 289, 292, 322, 326, 327, 328, 357, 358, 359, 368, 369, 380, 380, 389, 398, 428, 455, 456, 459, 461, 522, 585, 825, 975*

643 **Sequence of phase transformations in the Zr-14AT%AL alloy.** Mukhopadhyay, P.; Banerjee, S. (Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.). pp II41-II46 of Phase transformations. Vol. 2. London, England; Institution of Metallurgists ([nd]).

From Phase transformation spring residence conference; Heslington, York, UK (4 Apr 1979).

The evolution of the equilibrium $Zr_3Al$ phase through a peritectoid reaction has been studied recently. The sequence of phase transformations encountered in an alternative route of production of this phase through precipitation from a supersaturated Zr-Al martensite is described here. In this context simultaneous operation of continuous ordering and spinodal clustering processes is discussed.

644 **$\beta/\alpha$ phase transformation in zirconium and certain zirconium based alloys.** Marques, F.D.S. (Universidade do Minho, Guimaraes (Portugal)). pp IV23-IV31 of Phase transformations. Vol. 2. London, England; Institution of Metallurgists ([nd]).

From Phase transformation spring residence conference; Heslington, York, UK (4 Apr 1979).

Zirconium and zirconium based alloys transform on cooling from the high-temperature body centered cubic structure ($\beta$-phase) to the low-temperature hexagonal close packed structure ($\alpha$-phase) and on heating the reverse transformation takes place. This transformation has considerable fundamental and practical interest since it is the basis of heat treatable zirconium alloys. Significant controversy has arisen regarding its nature, which has been considered either massive, bainitic or martensitic. The present work has been carried out in order to investigate the effect of continuous cooling rates and alloying additions on the kinetics and crystallography of the transformation, and on the morphology, substructure and strength of the transformation products.

645 **Martensite formation and reversion and their effects on the void swelling of austenitic steels.** Bowkett, M.W.; Harries, D.R. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). pp V26-V29 of Phase transformations. Vol. 2. London, England; Institution of Metallurgists ([nd]).

From Phase transformation spring residence conference; Heslington, York, UK (4 Apr 1979).

Detailed structural examinations have been carried out on solution annealed and cold-rolled En58B (Type 321) and M316 (a modified version of AISI 316) austenitic steels and on two experimental austenitic alloys of nominal base compositions 18%Cr:8%Ni and 18%Cr:12%Ni; the latter two alloys were selected for study because of their markedly different austenite stabilities with respect to deformation-induced martensitic transformation. This paper summarises the principal results of the structural examination of the four steels in the solution treated, cold worked and subsequently annealed conditions. In addition preliminary data on the void swelling characteristics of the 18/8 and 18/12 steels, following irradiation with $Ni^{4+}$ ions are described.

646 (AERE-TP—843, pp 171-181) **Radiation damage in metals.** Bullough, R. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Mar 1980. Dep. NTIS (US Sales Only).

In 25 years of theoretical physics 1954-1979.

Some of the important developments in research on radiation damage in metals in the last 20 years are reviewed with especial reference to those where progress has been due to, or has occurred in conjunction with, theoretical studies at AERE, Harwell. Among topics considered are; analysis of the role of vacancies and dislocations in the nucleation and growth of gas bubbles in fissile materials, dislocation loop energies and morphologies, the interaction of point defects with dislocations, the role of channeling and cascade damage, electron microscope image simulation, void swelling, void nucleation and void size distributions, and the importance in irradiation creep of interaction between point defects and dislocations.

647 (AERE-TP—843, pp 191-206) **Defect modelling.** Norgett, M.J. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Mar 1980. Dep. NTIS (US Sales Only).

In 25 years of theoretical physics 1954-1979.

Calculations, drawing principally on developments at AERE Harwell, of the relaxation about lattice defects are reviewed with emphasis on the techniques required for such calculations. The principles of defect modelling are outlined and various programs developed for defect simulations are discussed. Particular calculations for metals, ionic crystals and oxides, are considered.

648 (INIS-mf—6423, pp vp) **Effect of liquid sodium on behaviour of selected structural materials for steam generators of fast power reactors.** Fresl, M.; Eremias, B.; Rozumbersky, A.; Jarsky, L. (Statni Vyzkumny Ustav Ochrany Materialu G.V. Akimova, Prague (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

Experimental equipment is described for corrosion testing of materials for the steam generators of sodium cooled fast reactors. Experiments proceeded using a convection sodium loop with a

sodium flow rate of 0.1 m/s, a temperature gradient between the test sections of 100 to 150 deg C, and a temperature range of 400 to 700 deg C. Of the tested structural materials, steels were found advantageous of the 2.25Cr-1Mo type stabilized with niobium, titanium or the combination thereof, this for temperature not exceeding 520 degC. For temperatures up to about 650 degC, nonstabilized, austenitic corrosion resistant steel of the 03Cr18Ni11 type was found suitable. Alloys of the INCOLOY 800 type and ferritic steels containing 9 to 12% of chromium appear to be promising.

649 (INIS-mf—6423, pp vp) **Results of study in long-term properties of austenitic steels in liquid sodium.** Svoboda, V.; Merta, J. (Sigma, Prague (Czechoslovakia). Vyzkumny Ustav Cerpacich Zarizeni, Potrubi a Armatur). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The long-term creep properties as affected by liquid sodium were investigated of austenitic chromium-nickel steels used for the manufacture of fast reactor steam generators. Tests proceeded for $10^3$ to $10^4$ hours at 550, 600 and 650 deg C. For maintaining the desired life of pipe fittings and components of 30 years, ie., $2.63 \times 10^5$ hours, the permissible value of long-term creep strength was shown to be 127 MPa. Extrapolation of the results to a value of $10^5$ hours gave the permissible stress level of about 147 MPa.

650 (INIS-mf—6423, pp vp) **Effect of long-term action of liquid sodium on resistance of steels 17346 and 17349 to low-cycle fatigue.** Kneifl, M. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)); Fresl, M. (Statni Vyzkumny Ustav Ochrany Materialu G.V. Akimova, Prague (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

The effect of sodium on AISI 316 type steel fatigue was studied. Steel specimens were exposed to liquid sodium at a temperature of 500 deg C for 1000 hours. Afterwards, the specimens were tested for low-cycle fatigue in the air at 550 deg C. After crack initiation, chemical analysis was carried out of the specimens and the chemical compositions of the surface layer and the point of crack formation were compared. The results show that in the above conditions, no deterioration of surface layer properties takes place and that there is no significant difference in the life of controls and of the sodium-exposed specimens in low-cycle fatigue.

651 (INIS-mf—6423, pp vp) **Approaches to experimental testing of steel properties in liquid sodium.** Mohyla, F.; Walder, V. (Vyzkumny Ustav Hutnictvi Zeleza, Dobra (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

Methodological problems are discussed related to the design of experiments testing steel properties in liquid sodium. Factor experiments are used for determining the influence on important properties of steels, (related to the life of fast reactor steam generators: of various factors, such as materials quality, impurities in sodium, temperature distribution, etc. Two factor levels are distinguished of which the former are called effects. They can be controlled via the second set of actual factors, such as concentrations, temperatures, time, etc. The classification of effects and their evaluation is shown.

652 (INIS-mf—6450, pp vp) **In situ studies of transfer annealing in doped crystals of potassium chromate and trisdipyridylcobalt(III: perchlorate trihydrate.** Collins, K.E.; Collins, C.H. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica); De Jesus F, M.; Heitz, Ch.; Freidt, J.M. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1980. Dep. NTIS (US Sales Only).

From 3. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (8 Dec 1980).

653 (IWGFPT—7, pp 9-16) **Influence of environmental variables and irradiation on iodine stress corrosion crack initiation and growth in Zircaloy.** Lunde, L.; Videm, K. (Institutt for Energiteknikk, Kjeller (Norway)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

Variables in the SCC testing technique and the effect of the fast neutron dose appear to explain most of the controversy about the effect of irradiation damage on the SCC behavior of Zircaloy. On the basis of extensive laboratory testing functions expressing the time for stress corrosion crack (SCC) initiation and the rate of crack propagation at different stresses and temperatures have been worked out. The environmental variables in the SCC test can have a much larger influence on the life-time for autoclaved material than for pickled and sandblasted metal. For irradiated (oxidized) material a ten times increase in the iodine concentration reduced the failure stress from 500 to 250 MPa. By comparing our results with published data it is concluded that the failure stress (after 1 to 3 hours) is very dependent upon the neutron dose. Neutron damage will raise the stress threshold for doses up to $10^{20}$ n/cm$^2$ and thereafter the failure stress is gradually decreased to low values with increasing neutron doses up to $5.10^{21}$ n/cm$^2$.

654 (IWGFPT—7, pp 17-20) **Model for the kinetics of the $\alpha$ diversable $\beta$ phase transformation in Zircaloy-4.** Holt, R.A.; Sills, H.E.; Sagat, S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

A transient creep model has been developed to predict the high-temperature deformation of Zircaloy-4 sheaths that represents those changes in sheath microstructure (i.e., grain size, dislocation density, phase fraction, etc.) which affect creep rate. Because $\alpha$-Zircaloy-4 creeps about $10^4$ times slower than $\beta$-Zircaloy-4 in the $\alpha + \beta$ phase field (1070 to 1270 K), accurate predictions of phase fraction are required in order to predict creep rates at these temperatures. Cooling rates of 5 K/s cause a 30 K shift downward from equilibrium which is equivalent to an order of magnitude change in creep rate from the equilibrium condition. To improve the prediction of creep rate in this temperature range, an empirical model has been developed for the phase transformation kinetics to replace the equilibrium model used initially.

655 (KFTI—78-25, pp 57-62) **Heat treatment of refractory metals in vacuum.** Amonenko, V.M.; Ryabchikov, L.N. 1978. (In Russian). Dep. NTIS (US Sales Only).

From 1. All-union seminar on cryogenic techniques for high-vacuum production; Khar'kov, Ukrainian SSR (22 - 24 Nov 1977).

Generalized is the outcome of the research, carried out in the KFTI of the Ukraine Academy of Sciences, in which metals are freed from the admixtures. Mainly the physical and chemical processes, taking place in the "metal-gas" systems, have been studied. The content of gas and carbon in metals have been researched by the methods of chemical analysis; microhardness has been measured. The constants of the crystalline lattice and of the surface phases have been studied by the X-ray structure analysis. The gas partial pressure, their liberation and absorption rates have been measured using the mass-spectrometry method. The coefficients of the hydrogen diffusion in molybdenum and tungsten at 1.000-1.800 deg C have been determined. The oxidation activation energy for Mo and W has been determined as equal to 12.8 and 21.1 Kcal/mol $O_2$, respectively. The carbide formation on the surface is the basic reason for the embrittlement of Mo and W following the vacuum annealing. At low pressure the oxidation of V, Nb and Ta reaches its maximum at 1.600 deg C. This is stipulated by the competing diffusion and adsorption stages of the absorption process. Above 2.000 deg C de-oxidation is observed. Heat treatment of Nb in vacuum during the inleakage of $O_2$ and $N_2$ is conducive to strengthening, particularly during testing in the region of 300 deg C and 500 deg C. The coefficients of the O and N adhesion onto Zr at 900-1.600 deg C amount to 0.47-0.94 and 0.01-0.1, respectively. Absorption of gases during heat-treatment in vacuum strengthens Zr and changes its structure.

656 (KFTI—79-65, pp 16-20) **Simulation of subthreshold effects in nickel.** Gann, V.V.; Vaisfel'd, A.M.; Yamnitskii, V.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. All-union school on radiation damage physics; Alushta, Ukrainian SSR (23 Sep - 4 Oct 1979).

A dynamic crystal model for calculation of the instable defect density is suggested. The defects are divided into stable and instable after completing the calculation of a next cascade. A technique has been developed which permits the instable defect density to be obtained for any primarily knocked-on atom spectrum. For example, the instable defect density in nickel for the reactor neutron spectrum at $10^{18}$ $cm^{-2}s^{-1}$ flux constitutes $1.2x10^{7}$ $cm^{-2}$. It has been found that the contribution of instable defects to the mechanisms of radiation-induced phenomena becomes substantial at temperatures below 60 K.

657 **Dynamic surface composition changes in Ag-Pd alloys under ion bombardment at different ion energies.** Opitz, M.; Petz, G. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik). pp 40-45 of SASP Symposium on atomic and surface physics 80. Proceedings of the symposium held in Salzburg, Austria, 10-16 Feb 1980. Innsbruck, Austria; Institut fur Astrophysik der Univrsitat Innsbruck (1980).

From Annual meeting of the Government Industrial Development Laboratory; Hokkaido, Sapporo, Japan (27 Feb 1980).

Ion bombardment of Ag-Pd alloys results in surface enrichment of Pd. Investigating the surface composition with Auger Electron Spectroscopy (AES), when the bombarding ion energy is changed from 5 to 0.5 keV and vice versa, a transition region is found where the surface composition shows rapid changes until a new equilibrium is reached. These dynamic changes can be attributed to altered layers of different thickness and different times to reach a new equilibrium for distinct ion energies.

658 **Radiation-enhanced permeation of $H_2$ in stainless steel.** Dobrozemsky, R.; Schwarzinger, G.; Stratowa, C.; Breth, A. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.). pp 64-69 of SASP Symposium on atomic and surface physics 80. Proceedings of the symposium held in Salzburg, Austria, 10-16 Feb 1980. Innsbruck, Austria; Institut fur Atomphysik der Universitat Innsbruck (1980).

From Annual meeting of the Government Industrial Development Laboratory; Hokkaido, Sapporo, Japan (27 Feb 1980).

Measurements of the radiation-enhanced diffusion and permeation of hydrogen in stainless steel type 4301 (s.s.304) at 840 K are reported. As radiation source the authors used an edge position of the ASTRA-reactor core (dose rate 0.5 W/g). The permeation-as well as the diffusion-coefficient were found to be considerably larger during irradiation than the thermal effect at the same temperature (measured by ohmic heating with the reactor shut off). A detailed description of the apparatus is given together with a discussion of the results hitherto achieved.

659 **Carbon deposition on iron and steel surfaces.** Brown, A.B.; Emsley, A.M.; Hill, M.P. (Central Electricity Research Labs., Leatherhead (UK)). pp 26-34 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Carbon deposits formed by the pyrolysis of hydrocarbons or disproportionation of CO over transition metal surfaces consist of crystalline graphite and are formed at temperatures appreciably lower than that normally required for the graphitisation of carbon in the absence of a metal. Two reaction mechanisms have been proposed, (i) that carbon dissolves in the metal and because of its high mobility it nucleates at suitable sites and then precipitates with graphitic ordering, and (ii) that a carbide is formed on the metal surface which on thermal decomposition yields graphite. The first mechanism was regarded as particularly applicable to metals with a high solubility for carbon. Further support for the solution/precipitation theory is the observation that amorphous carbon deposited on Ni and Co films and dissolved by raising the metal temperature, can be precipitated as well-oriented graphite films by cooling. Several different deposit morphologies have been reported but the relative importance of physical and chemical contributions to their growth is not understood. The metallurgical structure of the specimen can also influence the reaction, and further aspects will be discussed below. Carbides, oxides and the metal itself have been regarded by various workers as active catalysts for deposition but this problem remains unresolved because of the difficulty of identifying intermediates in high temperature gas-solid reactions. The object of this paper is to present further results on the morphological, metallurgical and catalytic aspects of carbon deposition.

660 **Towards the development of mechanistically-based design rules for corrosion fatigue in ductile steels.** Johnson, R.; McMinn, A.; Tomkins, B. (UKAEA Springfields Nuclear Power Development Labs.). pp 371-379 of Mechanical behaviour of materials. Vol. 2. Proceedings of the third international conference held in Cambridge, England, 20-24 August 1979. Miller, K.J. (Sheffield Univ. (UK)); Smith, R.F. (Welding Inst., Cambridge (UK)) (eds.). Oxford, England; Pergamon (1980).

From 3. international conference on mechanical behaviour of materials; Cambridge, UK (20 Aug 1979).

This paper shows how the crack growth characteristics of materials (e.g. A 533-B and Ducol W 30) used in nuclear pressure vessels can be used to check the design lines. It also points out not only where changes in the crack growth mechanism in different environments can result in differing lifetime predictions, but also where more work is required to substantiate fully or extend the changes in design curves that are already indicated as necessary.

661 **Low cycle fatigue behaviour and cumulative damage effect of SA-516-70 steel at room and high temperature.** Bernard-Connolly, M.; Biron, A.; Bui-Quoc, T. (Ecole Polytechnique, Montreal, Quebec (Canada). Dept. de Genie Mecanique). pp 297-301 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

Many components in Candu-type nuclear power plants such as heat exchangers and pressurizers are fabricated from normalized SA-516 grade 70 steel. Such components are usually operated with variable loadings at high temperature and little information concerning the fatigue properties of this material is presently available. The purpose of the present investigation is to provide some elements of that information. Tests have been carried out at 20 and 427°C with controlled cyclic strain at a fixed temperature, first at constant amplitude to establish standard fatigue curve, and then with two increasing or decreasing strain levels for cumulative damage study. In addition, two constant amplitude fatigue tests were carried out at 538°C. The present work is a continuation of experimental studies on the low cycle fatigue behaviour of materials. In particular, test results on 304 stainless steel at 20, 538 and 650°C with two strain levels have shown that the order of strain applications and the differences between the strains involved are important parameters in the summation of cycle ratios. In this paper, test results on SA-516-70 are reported. The fatigue curve and remaining life are discussed with an emphasis on evaluation methods which have been developed from a cumulative damage concept applicable to fatigue studies with controlled strain.

662 **High cycle fatigue of 2.25Cr-1Mo steel at elevated temperatures.** Jaske, C.E.; Frey, N.D. pp 303-313 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

Information on the elevated temperature, long life ($> 10^5$ cycles to failure) fatigue resistance of pressure vessel and piping alloys is needed to properly design structural components subjected to low amplitude cyclic loadings at high temperatures. The high cycle fatigue resistance of annealed 2 1/4 Cr-1Mo steel has been

evaluated in air at temperatures up to 538°C. A design fatigue curve has been developed for temperatures <= 427°C, and a design fatigue curve has been developed for 538°C maximum temperature. These curves are for strain rates >= 4 x $10^{-3}$ $sec^{-1}$, more long life fatigue data are needed for applications at lower strain rates. The effect of tensile mean stress on fatigue life has been evaluated. Design fatigue curve corrections for maximum effect of mean stress appear to be adequate at <= 427°C, but they may not be satisfactory at higher temperatures. The present experimental work was limited to constant amplitude cycling and a crack initiation failure criterion.

663 **Study on thermal fatigue endurance under biaxial stress state.** Spandick, W. (Krupp (Friedr.) G.m.b.H., Essen (Germany, F.R.). Forschungsinstitut). pp 339-345 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

The design specifications for pressure vessels permit the yield point to be exceeded considerably in the case of secondary stresses. Pressure vessel components must therefore often be designed for fatigue endurance. Dimensioning in accordance with the ASME Code has hitherto been based on uniaxial mechanical tests with emphasis on high safety factors. The influence of a multi-axial stress on the number of load cycles and the effect of thermal cycles on the course of material fatigue remain largely unclear. The recent investigations described here are aimed at determining in suitable experiments to what extent actual stresses set up by thermal cycles in a biaxial stress field are covered by the simple approach hitherto used in practice. At the same time the limitations of the materials when exposed to these complex stresses are determined. The following experiments were carried out to solve the above questions: thermal biaxial load cycle tests with carbon and austenitic steels, determination of service life as a function of the constrained strains, determination of the stress/strain curve in the form of a Bauschinger loop. Establishing the stress/strain curve is especially important since from it is derived the tangent modulus introduced in the computation of the buckling stress of components subjected to such stresses. Results are given and discussed.

664 **Fatigue crack propagation under elastic plastic medium at elevated temperature.** Asada, Y.; Yuuki, R. (Tokyo Univ. (Japan)); Sakon, T.; Sunamoto, D. (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)); Tokimasa, K. (Sumitomo Metal Industries Ltd., Osaka (Japan)); Makino, Y. (Sumitomo Heavy Industries Ltd. (Japan)); Kitagawa, M (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)); Shingai, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). pp 347-352 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

The purposes of the present study are to establish the testing method to obtain compatible data on the low cycle fatigue crack propagation at elevated temperature, and to investigate the parameter controlling the crack propagation rate. In the present study, the preliminary experiments have been carried out on low cycle fatigue crack propagation behaviour in type 304 stainless steel in air at 550°C, using two types of specimen with a through thickness notch. Both strain controlled and stress controlled fatigue tests have been done under a fully reversed strain or stress cycling. The data obtained are correlated with some fracture mechanics parameters and are discussed with the appropriate parameter for evaluating the low cycle fatigue crack propagation behaviour at elevated temperature.

665 **Evaluations of the criterion for lateral expansion of steels for nuclear components.** Susukida, H.; Satoh, M. (Mitsubishi Heavy Industries Ltd., Takasago, Hyogo (Japan). Takasago Works); Ando, K. (Ishikawajima-Harima Heavy Industries Co. Ltd., Yokohama (Japan). Yokohama No.2 Works); Sakaguchi, Y. (Babcock Hitachi K.K., Tokyo (Japan)); Fukuhara, A. (Nippon Steel Corp., Tokyo); Tanabe, J. (Japan Steel Works Ltd., Tokyo); Ando, Y. (Tokyo Univ. (Japan)). pp 361-368 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

The Charpy V notch impact tests were performed on Japanese made ferritic steels for nuclear components and their lateral expansions were investigated. The correlations of lateral expansion and absorbed energy with yield strength, and the correlation between lateral expansion and fracture toughness were also studied. The correlation at each lateral expansion level between absorbed energy and yield strength almost agreed with that published by the US PVRC. It was confirmed that lateral expansion could be used as a criterion for the toughness of the steels corresponding to changes in their yield strength, and that the lateral expansion criterion adopted in the ASME Code Section III was appropriate. Further, the correlation between fracture toughness and lateral expansion and that between fracture toughness and absorbed energy, were evaluated, and respective equations of correlation were proposed.

666 **Static and dynamic fracture toughness behaviour of heavy section steels for nuclear pressure vessels.** Tsukada, H.; Iwadate, T.; Tanaka, Y.; Ono, S. (Japan Steel Works Ltd., Muroran, Hokkaido. Muroran Plant). pp 369-374 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

The use of a small size round compact tension specimen to measure the dynamic fracture toughness Jsub(Id) of the materials was recommended and confirmed for the surveillance tests. The static and dynamic fracture toughness of ASTM A508 Cl.2, A508 Cl.3 and A533 Gr.B Cl.1 steels in the wide range of temperature including the upper shelf were measured and their behaviour was analysed on the scanning electron microscope observation. Based on the fracture toughness data obtained, a prediction method of static and dynamic fracture toughness of nuclear pressure vessel steels from Charpy V notch test results was also developed.

667 **Fracture toughness and crack growth resistance of submerged arc and manual metal arc weldments in A533B plate.** Milne, I.; Curry, D.A. (Central Electricity Research Labs., Leatherhead (UK)). pp 375-381 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

Fracture toughness and ductile crack growth resistance data are presented for submerged arc (SA) and manual metal arc (MMA) weldments in 130 mm thick A533B class 1 steel plate. Toughness tests were performed on 50 mm and 125 mm square single edge notched bend specimens over the temperature interval -100°C to +100°C. The fracture toughness at the onset of cracking in MMA and SA weld metals and heat affected zone (HAZ) material was inferior to that of the parent plate, in both ductile and brittle regimes of cracking. The ductile brittle transition temperature was observed to increase with increasing specimen size. Several Charpy impact test:fracture toughness correlations have been examined using the current results. These correlations were broadly, but not entirely, satisfactory in predicting lower bounds to the observed initiation fracture toughness values.

668 **Fracture toughness of heavy section LWR pressure vessel steel plate produced by basic oxygen furnace and ladle refining process.** Ohashi, N.; Tanaka, M.; Enami, T. (Kawasaki Steel Corp., Chiba (Japan). Technical Research Lab.); Ooi, H.; Sekine, T. (Kawasaki Steel Corp., Kurashiki (Japan). Mizushima Works); Ando, Y. (Tokyo Univ. (Japan)). pp 391-396 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

This report deals with the recent results of test on the heavy section Mn-Ni-Mo steel plates produced by new facilities including the basic oxygen furnace, ASEA-SKF type ladle refining furnace. Various kinds of test have been conducted to assess the fracture toughness characteristics under static, (Ksub(Ic)), or dynamic, (Ksub(Id)), loading and those for arrest of propagating brittle crack, (Ksub(Ia)). Changes in the Ksub(Ic), Ksub(Id), Ksub(Ia) values obtained by small specimens and full-thickness CT and ESSO test specimens with temperature were measured. Over a full temperature range tested in this study, all Ksub(I) values exceed the Ksub(IR) curve which is specified in the ASME Code, and the results are therefore considered satisfactory for the material to be used in the construction of RPV's.

669 **Improvement of properties in heavy section nuclear reactor steel plates.** Kikutake, T.; Tsuda, Y.; Nakao, H.; Okamoto, K. (Nippon Steel Corp., Tokai-Shi, Aichin-Ken (Japan). Nagoya Works). pp 397-401 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

A533B Cl.1 steel used for nuclear reactor steel plate is required to have high fracture toughness to prevent brittle fracture in service. In recent years, however, heavier gauge steel plates are being used as the capacity of nuclear reactor pressure vessels continues to grow. This has caused various problems such as lowered cooling rate in the heat treatment carried out at fabrication and prolonged post-weld heat treatment time (increased temper parameter), making it more and more difficult to maintain desired toughness. To cope with this, the authors investigated metallurgical factors that can maintain the desired toughness even under such severe fabricating conditions, and found that reduced carbon content, improved hardenability and controlled N and Al contents are all effective in maintaining toughness. The improved steel exhibits superior toughness and ductility to the conventional steel even under harsh fabricating conditions and its strength is comparable to that of the conventional one. A study of the susceptibility to under clad cracking of the improved steel also revealed that there was no danger of this.

670 **Applicability of JIS SPV 50 steel to primary containment vessels of nuclear power stations.** Iida, K. (Tokyo Univ. (Japan)); Ishikawa, K. (Ishikawajima-Harima Heavy Industries Co. Ltd., Yokohama (Japan) Yokohama No. 1 Works); Sakai, K.; Onozuka, N. (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)); Satoh, M.; Soya, I. (Nippon Steel Corp., Sagamihara (Japan) Products Research and Development Labs.). pp 403-409 of Fourth international conference on pressure vessel technology. Volume 1. Materials, fracture and fatigue. London, England; Mechanical Engineering Pubs. Ltd., for the Institution of Mechanical Engineers (1980).

From 4. international conference on pressure vessel technology; London, UK (19 May 1980).

The fracture toughness of JIS SPV 50 steel and its weldment has been examined in order to verify the applicability of these materials to primary containment vessels of nuclear power stations. Test results were evaluated using elastic plastic fracture mechanics through the COD and the J integral concepts for non ductile fracture initiation characteristics. Linear fracture mechanics was employed for propagation arrest characteristics. Results showed that the materials tested here have a sufficient fracture toughness to prevent nonductile fracture and that this steel is a suitable material for use in construction of primary containment vessels of nuclear power stations.

671 **Phase equilibria in the uranium-chromium-carbon system.** Alekseeva, Z.M.; Ivanov, O.S. (AN SSSR, Moscow. Inst. Metallurgii). pp 247-270 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980). (In Russian)

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The alloys for this study (40 different compositions) were prepared by melting a charge comprising appropriate amounts of the various components and a 'master' alloy under an argon atmosphere on a water-cooled copper tray in an arc furnace equipped with a tungsten electrode. The starting components were uranium of 99.7% purity, graphite with an 0.004% ash content and electrolytically prepared chromium. The alloys were analysed by X-ray spectroscopy, X-ray diffraction analysis and microstructural methods, and a selective chemical analysis was made. As a result of these studies, a new compound of composition 45 at.%Cr - 10 at.%U - 45 at.%C was found; it was subjected to X-ray diffraction analysis. The composition of the compound x($UCr_2C_3$) was refined. The crystallization characteristics of the alloys were established over the entire composition range, a diagram of the non- and monovariant equilibria was drawn and the section for the sub-solidus temperature was constructed over the entire range of concentrations. The isothermal section at 1500-1600°C was constructed for the $UC_2$-UC-$UCrC_2$ region; this is characterized by a broad region consisting of a homogeneous solid solution of chromium in the high-temperature (UC-$\beta$-$UC_2$) solid solution, which the chromium stabilizes down to a lower temperature. The observed increase of the carbon content in the solid solution with increase in the content of iron can apparently explain the improvement of chromium-modified monocarbide nuclear fuel reported in the literature. The carbon content in uranium-based monocarbide fuel can be increased to approximately 55 at.% by the addition of approximately 7 at.% chromium without change in the crystal structure. The parameters of the tetragonal (UC-$\beta$-$UC_2$) lattice were determined to be a=5.041 A and c=5.128 A.

672 **Effect of small fourth-element alloying additions on the calculated phase stability in the Fe-Cr-Ni system.** Watkin, J.S. (UKAEA Springfields Nuclear Power Development Labs.). pp 297-314 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

Recent studies into the void swelling of Fe-Cr-Ni alloys have revealed that the magnitude of swelling depends upon alloy constitution and this, together with the fact that minor element additions also play a major role in swelling, necessitates a detailed knowledge of the influence of small fourth-element additions on phase stability. In this paper the effects of additions of niobium, titanium, aluminium, molybdenum, cobalt and carbon on the Fe-Cr-Ni ternary system are assessed by calculation. They confirm the ferritizing tendencies of niobium, titanium and aluminium and the strong austenitizing effect of carbon. Confirmation is also found for the scaling factors in the equivalent nickel and chromium equations in common usage and the paper presents Fe-Cr-Ni ternary sections at 400, 550 and 700°C modified for 1 at.% addition of each of the above elements.

673 **Calculation of the driving force for the radiation induced precipitation of $Ni_3Si$ in nickel-silicon alloys.** Miodownik, A.P. (Surrey Univ., Guildford (UK)); Watkin, J.S. (UKAEA Springfields Nuclear Power Development Labs.). pp 315-330 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The appearance of precipitates which have been identified as $Ni_3Si$ in irradiated stainless steels and nickel-rich alloys such as Inconel is of considerable interest in relation to the swelling behaviour of such materials. Work on binary nickel-silicon alloys has shown that $Ni_3Si$ can be induced to precipitate in alloys whose silicon content is well below the accepted solubility limit, and it has also been shown that such precipitates redissolve when heat-treatment is continued at the same temperature in the absence of irradiation. Such effects imply an irradiation induced shift of chemical potential, and cannot be explained by merely involving accelerated diffusion. This paper represents an attempt to calculate the shift in chemical potential required to precipitate $Ni_3Si$ in alloys containing 1-10 at.% Si over a range of temperatures (300-1000K), and then proceeds to relate this calculated chemical potential to available information concerning the dose rates required to induce such precipitates at various temperatures. Presentation of the results is modelled on the well established methods for handling the time/temperature/transformation behaviour of ordinary alloy systems, with dose rate being substituted for the time axis. Analogous calculations are presented for nickel-germanium alloys, in order to check whether the numerical values deduced from the nickel-silicon system have more general applicability, and also to see whether there are any significant differences in a system where the size factor of the solute is of the opposite sign.

674 **Fracture toughness of nitrogen strengthened austenitic steels at 4K.** Krauth, H.; Nyilas, A (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). pp 119-128 of Fracture and fatigue, elasto-plasticity, thin sheet and micromechanisms problems. Proceedings of the third colloquium on fracture, London, 8-10 September 1980. Radon, J.C. (Imperial Coll. of Science and Technology, London (UK)) (ed.). Oxford, England; Pergamon Press (1980).

From 3. colloquium on fracture; London, UK (8 Sep 1980).

In this report the fracture toughness investigations of nitrogen strengthened austenitic steels used as structural material for the casing of large superconducting coils are represented. The safe operation of such large magnetic systems in a liquid helium environment necessitates the determination of fracture toughness data as an important material property for the purpose of preventing brittle fracture. The J-contour integral tests with small scale specimens were used for the measurements of the resistance curves at 4 K for AISI 316 LN type stainless steels. Beside the bulk material fracture properties, the fracture toughness of manual SMA-weldments and EB-weldments were also investigated. The establishment of the Ksub(IC)-critical data due to the J-integral measurements are demonstrated.

675 **Calcination studies on perovskite, zirconolite, barium hollandite and SYNROC-B.** Buyck, W.J.; Cassidy, D.J.; Webb, C.E.; Woolfrey, J.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Materials Div.). pp 105-111 of Austceram 80. Proceedings of the 9th Australian ceramic conference held at Sydney, August 1980. Sydney, Australia; Australian Ceramic Society (1980).

From 9. Australian ceramic conference; Sydney, Australia (27 Aug 1980).

SYNROC-B has been proposed as a vehicle for the immobilisation of solidified radioactive waste. It consists of an assemblage of three synthetic mineral phases: perovskite, barium hollandite, and zirconolite. The results of a study of the formation and fabrication of each mineral phase and of undoped SYNROC-B from its oxide components are reported.

676 **Design criteria for ion implantation equipment for surface treatment.** Dearnaley, G.; Goode, P.D. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). pp 26-35 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A summary is given of the ways in which ion implantation is now being used to achieve striking improvements in wear resistance in tools and engineering components and the present position regarding applications to the corrosion problem is reviewed. The requirements and design features of modern machines, work-chambers and ion sources are discussed. The dual process for the production of tough surfaces, consisting of ion implantation combined with coating techniques, in order to bring about the in-diffusion of material, is examined.

677 **Fracture and fatigue, elasto-plasticity, thin sheet and micromechanisms problems.** Radon, J.C. Oxford, England; Pergamon Press (1980). vp. (CONF-8009191—).

From 3. colloquium on fracture; London, UK (8 Sep 1980).

Abstracts of individual items from the colloquim were prepared separately for the data base.

678 **Compatibility of molten salts with type 316 stainless steel and lithium.** Keiser, J.R.; Devan, J.H.; Lawrence, E.J. (Oak Ridge National Laboratory, Oak Ridge, Tenn.). *Journal of Nuclear Materials;* **85-86**: 295-298(Dec 1979).

Molten salts with possible application in fusion reactors have been studied. The corrosion rate of type 316 stainless steel in LiF-BeF2, KNO3-NaNO2-NaNO3, and LiF-LiCl-LiBr was strongly affected by the temperature and oxidation potential of the salt. A rapid exothermic reaction occurred when KNO3-NaNO2-NaNO3 was melted with lithium.

679 **Mechanical properties of materials in fusion reactor first-wall and blanket systems.** Bloom, E.E. (Oak Ridge National Laboratory, Oak Ridge, Tenn.). *Journal of Nuclear Materials;* **85-86**: 795-804(Dec 1979).

With respect to the effects of irradiation on mechanical properties, the most significant difference between fast fission and fusion reactor spectra is the relatively large amount of helium produced by (n, alpha) transmutations in the latter. Relevant information on the effects of large amounts of helium (with concomitant displacement damage) comes from irradiation of alloys containing nickel in mixed spectrum reactors. At helium levels of interest for fusion reactor development, properties are degraded to unacceptable levels above 0.5 T(m). Below this temperature, strength and ductility are retained and fractures remain transgranular. Importantly, the properties remain sensitive to composition and structure. A comparison of the response of bcc refractory alloys to that of stainless steel at equivalent damage levels shows the same general trends in properties with homologous temperature. The refractory alloys do offer potential for higher temperature applications because of their higher melting temperatures.

680 **The ductility in bending of molybdenum alloys irradiated between 425 and 1000 C.** Cox, B.L.; Wiffen, F.W. (Oak Ridge National Laboratory, Oak Ridge, Tenn.). *Journal of Nuclear Materials;* **85-86**: 901-905(Dec 1979).

Molybdenum and the alloys Mo-0.5% Ti and TZM were irradiated at four temperatures between 425 and 1000 C to a displacement level of 11 dpa at a fluence of 2.5 x 10 to the 26th n/sq m (above 0.1 MeV). Vacuum bend tests at elevated temperatures showed the ductile-to-brittle transition temperature (DBTT) to be above room temperature for all irradiation temperatures. Irradiation at 585 C produced the highest DBTT, 550 to 700 C. Differences among the three materials were minor.

681 **Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles.** Shindo, M.; Suzuki, T.; Kondo, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). pp 15-25 of Proceedings of the second U.S.-Japan seminar on HTGR safety technology, 2. Material properties and design methods; seismic research. Tokai, Ibaraki; JAERI (Jun 1979).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

The compositional change in corrosion product spalled during oxidation in the simulated HTR coolant under temperature cycling was examined by activation analysis. Comparison of three heats with different Mn, Al, Si and Co content, which influenced the behaviour of the materials significantly, susceptibility to intergranular attack suppressed to release of the radioactive products. Close relation was also found between the chemical composition of oxide film and the corrosion resistance. A special reference was made to the essential factors that control the rate of total release of Co into the environment system.

682 **Corrosion resistance of Ni and Mo coated super alloy in He-high temperature environment.** Murase, H.; Fukasako, N.; Matsuda, S.; Kita, K. (Kawasaki Heavy Industries Ltd., Akashi, Hyogo (Japan). Technical Inst.). pp 36-47 of Proceedings of the second U.S.-Japan seminar on HTGR safety technology, 2. Material properties and design methods; seismic research. Tokai, Ibaraki; JAERI (Jun 1979).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

They say that Ni and Mo have high corrosion resistance against impurities in He gas. So, in order to investigate the possibility that corrosion resistance of alloys might be improved by coating these metals on them, some oxidation behaviors of super alloys with spray coating of Ni and Mo were studied at 1,000°C for duration up to 600 hours in HTR-B Helium gas. The principal results are as follows. (1) Mo coated alloys show not only high corrosion resistance but also good long term stability because of no diffusion of alloying elements from matrices to coatings. However, it was observed that adequate thin coating should be selected to avoid cracking in coating. (2) Ni coated alloys show lower corrosion resistance than Mo coated alloys because considerable diffusion of alloying elements take place from matrices to coatings, though they have higher resistance against cracking than Mo coated alloys. (3) The possibility that Super alloys with large quantity of Co would be used as materials of high temperature parts except reactor core was found.

683 **Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys.** Aronson, S.; Friedlander, M. (Brooklyn Coll., NY (USA)); Chow, J.G.Y.; Soo, P. pp 57-65 of Proceedings of the second U.S.-Japan seminar on HTGR safety technology, 2. Material properties and design methods; seismic research. Tokai, Ibaraki; JAERI (Jun 1979).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

Preliminary experiments have been carried out to determine how fission product interactions may influence the mechanical integrity of reference HTGR structural metals. In this work Type 304 stainless steel, Incoloy 800 and Hastelloy X were heated to 550 - 650°C in the presence of CsI. It was found that no corrosion of the alloys occurred unless air or oxygen was also present. A mechanism for the observed behavior is proposed. A description is also given of some long term exposures of HTGR materials to more prototypic, low concentrations of $I_2$, $Te_2$ and CsI in the presence of low partial pressures of $O_2$. These samples are scheduled for mechanical bend tests after exposure to determine the degree of embrittlement.

684 **Corrosion of inconel 617 in simulated HTGR helium environment.** Hirano, T.; Okada, M.; Araki, H.; Yoshida, H.; Watanabe, R. (National Research Inst. for Metals, Sakura, Ibaraki (Japan). Tsukuba Lab.). pp 66-76 of Proceedings of the second U.S.-Japan seminar on HTGR safety technology, 2. Material properties and design methods; seismic research. Tokai, Ibaraki; JAERI (Jun 1979).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

Corrosion tests of Inconel 617 in the simulated HTGR helium environment were carried out and the effect of the environment on the corrosion behavior was investigated. The principal results obtained were as follows: (1) The corrosion behavior of chromium, molybdenum, and silicon depended strongly on whether carburization occurred or not during test. (2) Weight gain, depth of internal oxidation, and depth of chromium depleted zone had a good relation with oxidation ratio in the environment where oxidation occurred mostly but not in the environment where oxidation and carburization occurred simultaneously.

685 **Enhanced negative secondary ion emission with cesium ion bombardment.** Storms, H.A.; Brown, K.F.; Stein, J.D. (General Electric Co., Pleasanton, CA (USA). Vallecitos Nuclear Center). pp 267-272 of Secondary ion mass spectrometry. Fundamentals and applications. Someno, M. (Tokyo Inst. of Tech. (Japan)); Wittru, D.B. Tokyo, Japan; Riaru-Kogeisha Ltd. (Mar 1979).

From 2. Japan-United States joint seminar on secondary ion mass spectrometry; Takarazuka, Hyogo, Japan (23 Oct 1978).

Relative secondary ion yields from numerous pure elements and simple compounds were measured for $Cs^+$ and $O^-$ primary ion bombardment. Cesium ion bombardment resulted in enhanced negative secondary ion emission, particularly for those electronegative elements resulting in low positive ion yields with $O^-$ bombardment. By producing high negative secondary ion yields, $Cs^+$ bombardment significantly improves detection sensitivity for certain elements relative to bombardment by other commonly used primary ions. Among the elements with increased detection sensitivity are H; C; Groups V, VI, and VII elements; and the noble metals. Cesium bombardment provides a powerful tool for extending the analytical capabilities of secondary ion mass spectrometry.

686 **Corrosion behaviour of Ni-Re, Ni-Re-Mo, Ni-Re-Hf, Ni-Re-W-Hf alloys.** Parshutin, V.V.; Andreeva, L.N.; Arskaya, E.P. pp 124-128 of Fiziko-khimicheskie svo stva splavov reniya. Moscow, USSR; Nauka (1979). (In Russian)

Corrosive behaviour of the Ni-Re double alloy and the effect of Mo, W and g alloying impurities on the noncorroding properties of the Ni-Re alloy in different media (HCl, $HNO_3$, $H_2SO_4$, $H_3PO_4$, NaCl, NaOH) haVe been studied. The analysis of alloy polarization curves showed that the most increase in the resistance to Ni-Re corrosion occurs when the latter is doped with hafnium. The corrosion mechanism of alloys and their components is discussed.

687 **Unified study of static and dynamic properties of alkali metals.** Sarkar, S.K.; Sen, D.; Das, S.K.; Roy, D. (Presidency Coll., Calcutta (India). Dept. of Physics). pp 678-685 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

An attempt is made to judge the reliability and inadequacy of the pseudopotential in Ashcroft model, used for studying the properties of alkali metals, by performing a consistent unified calculation. The lone parameter rsub(c) of Ashcroft's model pseudopotential is determined from the equilibrium condition. The static properties like cohesion, the second order elastic constants and their pressure derivatives and the dispersion curves along the symmetry directions are also studied. It is found that, the cohesive energy agrees excellently with experiment; the maximum discrepancy of about five percent occurs for Li; for the three other metals Na, K and Rb, the agreement is almost exact; the elastic constants agree within five percent for Li and Na; for K and Rb the discrepancy varies from fifteen to twenty five percent and calculated values are always higher; for pressure derivatives, the agreement for $dC_{11}/dp$ is surprisingly good-the discrepancy is less than four percent in all cases. But for $dC_{44}/dp$ the discrepancies are much larger and vary from ten percent for (Na) to about twenty percent. In the case of dispersion curves, however, the results are found to be very disappointing. Maximum disagreement near zone boundaries is about forty percent. It is pointed out that such disagreement has nothing to do with the neglect of third and fourth order pertur-

bation terms, which have much less contributions. A fair agreement in dispersion has been achieved with widely different rsub(c) values impairing seriously the equilibrium condition and all other agreements achieved in static properties. The reason for this failure to produce good results for both static and dynamic properties simultaneously is examined critically and it is concluded that the empty core approximation of Ashcroft is too drastic.

688 **Crystal dynamics and specific heat of copper doped alloys.** Tiwari, M.D.; Ram, P.N.; Sharma, G.K. (Garhwal Univ., Srinagar, Uttar Pradesh (India). Dept. of Physics). pp 692-695 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

Vibration of substitutional impurities in solids has been discussed using a Green's function technique. Within the general scheme of crystal impurity problem an expression has been derived for the change in lattice specific heat due to the presence of substitutional impurities. In the low concentration limit the theory has been employed to discuss the low temperature specific heat of $\alpha$-phase alloys based on copper. Experimental results of low temperature lattice specific heat in Cu:Zn, Cu:Ga and Cu:Ge have been successfully explained and thus local variation in force constants between substitutional impurity and host atoms has been estimated taking nearest neighbour approximation. The lattice dynamics of pure crystal has been discussed in the harmonic approximation using Kreb's model; the eigen frequencies and eigen vectors are utilized to calculate the Green's function pertaining to the problem. The importance of force constant changes in addition to the changes in the mass at the impurity site has been brought out and it has been established that the enhanced or reduced (in some alloys) specific heats are dominated by force constants changes and in fact are very much sensitive to these changes. It has been found that at very low temperatures, the contribution to lattice specific heat due to even parity symmetry modes A1g, Eg, F1g and F2g are quite significant and, in fact, dominate over that of Fsub(1u) symmetry mode in which the impurity atom moves. However, it is observed that at higher temperatures more impurity modes appearing in the Fsub(1u) irreducible representation are excited and their contribution dominates over all others.

689 **Elastic plastic fracture toughness values for a Hastelloy alloy sample submitted to a static load.** Morgand, P.; Churier, H. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). pp F5/9 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. F. Structural analysis of reactor core and coolant circuit structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In French)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In the High Temperature Reactor research programm of the French CEA, Hastelloy alloy plates contain mineral fibers used as insulating material and as such prevent the concrete core vessel from receiving excess heat. Due to the high pressure exerted on this insulating material, the Hastelloy plates are heavily stressed and, therefore, it is important to know their fracture strength. In the case of an elastic, brittle material, the fracture toughness is commonly defined through the well knownKsub(1c) parameter. But, for plastic materials, measuring Ksub(1c) requires very large samples and it was found more convenient to measure the fracture parameter Jsub(1c) instead of Ksub(1c). This parameter was determined according to the RICE or to the more sophisticated HERKLE and CORTEN formula. Two independent ways were followed to measure Jsub(1c): In the first one the shape of the crack after loading was made apparent by some fatigue cycles. After complete fracture of the sample, the amount of crack extension appears clearly and it becomes possible to generate a J resistance curve. As an alternative, we partially unloaded the specimen to get its compliance: the change in compliance was then supposed to coincide with the start of the crack extension. Finally a finite element code was used to compute the specimen state at the beginning of the crack extension. So we are able to obtain the shape of the Load-Displacement curve and to compare it with the experimental one.

690 **Evidence for the relative importance of dynamic fracture toughness.** Ireland, D.R. (Effects Technology, Inc., Santa Barbara, CA (USA)); Tominaga, S.; Maruyama, T. (Babcock Hitachi Ltd., Kore, Hiroshima (Japan). Kure Research Lab.). pp G6/1 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. G. Structural analysis of steel reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper presents the results of a study to demonstrate that when a localized embrittled area fractures, the surrounding material exhibits characteristics like that for dynamic loading. The material employed in this investigation was ASTM A533 Grade B Class 1 steel. Specimens were prepared from material at the 1/4 thickness area of plates ranging in thickness from 180 to 250 mm. Fracture toughness tests employed three point bend specimens of 20 and 50 mm thickness. Dynamic fracture toughness (Ksub(Id)) was determined by the computational methods of ASTM Method E399 and the specimens were loaded by impacting with a drop weight system. The dynamic tests were performed over the temperature range of -50 to +30°C. Machined notch specimens (0.1 mm radius) with and without a small embrittled zone (0.3 to 0.5 mm thick) at the notch tip were also evaluated. The embrittled zone was produced by soaking the specimens in $NH_3$ gas at 550°C for 40 hours and then quenched. Static tests of the machined notch specimens with the local embrittled zone produced linear elastic fracture Ksub(Q) values of the same magnitude as for the dynamic Ksub(Id) values from fatigue precracked specimens. The equivalent energy method for estimating lower bound values of toughness for elastic-plastic fractures produced the same results for both 20 mm and 50 mm thick specimens. The results of this study indicate that the role of dynamic fracture toughness characteristics in a nuclear pressure vessel safety analysis may be larger than that of an over conservative approach to a low probability incident.

691 **Criterion for analysing fatigue crack initiation in geometrical singularities.** Devaux, J.C. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 71 - Saint Marcel (France). Div. des Fabrications); D'Escatha, Y. (Service de l'Industrie et des Mines, 21 - Dijon (France). Bureau de Controle de la Construction Nucleaire); Rabbe, P. (Societe Creusot-Loire, 42 - Unieux (France). Centre de Recherche); Pellisier-Tanon, A. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Paris La Defense (France)). pp G8/1 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. G. Structural analysis of steel reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

It can be shown experimentally that the initiation of low cycle fatigue cracking at the tip of a notch tends to become independant of the radius of the notch when it becomes lower than a characteristic value which depends on the properties of the steel. It is thus possible to conceive a method for verifying the resistance to initiation of low cycle fatigue cracking in components bearing acute build in notches, which does not require to consider the details of the geometric construction of the tip of the notch.

692 **History dependence of stress-strain diagrams and creep curves under variable repeated loading.** Gokhfeld, D.A.; Sadakov, O.S.; Martynenko, M.E. (Chelyabinskij Politekhnicheskij Inst. (USSR)). pp L1/7 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The ability of structural alloys to 'keep in memory' the loading prehistory becomes of special importance when inelastic vari-

able repeated loading is considered. There are two main approaches to the development of the mathematical description of this phenomenon: the inclusion of hidden state variables in the incremental theory constitutive equations (a) and construction of proper hereditary functionals (b). In this respect the assumption that the 'memory' regarding the previous deformation history is due to structural nonhomogeneity of actual materials proves to be fruitful.

693 **Constitutive modelling in plasticity.** Kratochvil, J. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Pevnych Latek). pp L2/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Constitutive modelling of plastic behavior is treated as a sequence of a constitutive analysis, identification testing and a solution of the corresponding inverse problem. The constitutive analysis based on the internal variables approach generates a whole spectrum of plastic models of various degrees of flexibility. A higher flexibility enables more adequate modelling, however, the complexity of the corresponding identification testing program and the solution of the inverse problem grows with increasing flexibility very rapidly. Examples of the models of the spectrum suitable for monotoneous or cyclic loading are briefly analysed. An iteration procedure specifying a model adequate to an elastic-plastic stress analysis problem is suggested. A possipility to utilize inhomogeneous identification tests, each of which contains far more information than a homogeneous one, is mentioned.

694 **Damage postulate for nonproportional cyclic plasticity.** Leis, B.N. (Battelle Columbus Labs., OH (USA). Fatigue and Fracture Technology Projects Office); Laflen, J.H. (General Electric Co., Cincinnati, OH (USA)). pp L4/2 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper examines damage states and analysis for the multiaxial mechanical component of a general thermal-mechanical cyclic loading. Specifically, multiaxial histories developed under nonproportional cyclic plasticity synthesized through appropriate constitutive theories are used as a vehicle to discuss nonproportional damage processes and analysis. Nonproportional damage processes considered include both fixed and rotating principal planes. These are discussed in the context of an extension of a recent damage postulate for analysis of nonproportional action with fixed principal directions. It is shown that current data bases developed for use in damage analysis are, in general, inappropriate for applications to nonproportional cycling. The influence of transient inelastic response observed in studies of proportional cyclic plasticity on the damage state is also discussed.

695 **Creep ratcheting bounds based on elastic core concept.** Porowski, J.S.; O'Donnell, W.J. (O'Donnell and Associates, Inc., Pittsburgh, PA (USA)). pp L10/3 (1-12) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The present work includes isotropic and/or kinematic hardening effects and arbitrary temperature dependence of the yield strength of the material. The application of the bounds is extended to include loading histories with severe cycles resulting in plastic ratcheting. In general the relaxation of thermal stresses may result in a net accumulation of strain. The commonly used solution for complete relaxation between cycles does not include enhanced creep effects, and the latter are significant in many design applications.

696 **Modelization of the strain memory effect on the cyclic hardening of 316 stainless steel.** Chaboche, J.L. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France)); Van Dang, K.; Cordier, G. (Ecole Polytechnique, 91 - Palaiseau (France). Lab. de Mecanique des Solides). pp L11/3 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Life predictions in structures undergoing cyclic loads use the calculated stabilized stress-strain loops, for which plastic flow is introduced through cyclic constitutive equations. The paper deals with the description of strain history effects observed in some materials, especially in the 316 Stainless steel.

697 **Yielding of 6061-T6 aluminium tubings under dynamic biaxial loadings.** Ng, D.H.Y.; Lee, L.H.N. (Notre Dame Univ., IN (USA). Dept. of Aerospace and Mechanical Engineering). pp L12/5 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A test vehicle for applying biaxial, tension-internal pressure, loading to thin-walled tubular specimens over a range of loading rates has been developed. The test vehicle consists of a housing, a number of pistons and three pressure chambers. Static axial and hoop stresses can be obtained and controlled independently. For additional dynamic loading, the dynamic piston assembly which produces internal pressure to the specimen is driven inward by an impact of a spherical pendulum. The dynamic stress path of the specimen is a part of the natural response of the system partially controllable through adjusting the initial static stress state and impact velocity.

698 **Effect of biaxial loading and geometry on prediction of low-cycle fatigue life.** Konter, A.W.A.; Janssen, G.T.M. (Nederlandse Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft. Inst. for Mechanical Constructions); Husslage, W. (Nederlandse Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Apeldoorn. Metal Research Inst.). pp L13/1 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Data to predict failure by low-cycle fatigue are mainly based on uniaxial constant amplitude tests on solid specimens, although in practically all cases the state of stress of a reactor component is multiaxial. The effect of multiaxiality has been investigated on thin-walled tubular specimens. For the uniaxial loading condition a comparison has been made with tests on solid specimens. The investigated materials were 18Cr-11Ni steel (type AISI 304) at 20°C and 550°C and Nb-stabilized 2 1/4Cr1Mo steel at 500°C. The thin-walled tubular specimens have been loaded by combinations of cyclic axial load and cyclic torsion, with which a range of principal stress ratios between $-1 <= \sigma_2/\sigma_1 <= 0$ or principal strain ratios between $-1 <= \Delta\varepsilon_2/\Delta\varepsilon_1 <= -0.5$ could be achieved.

699 **Analysis of notch strain for cyclic loading.** Dowling, N.E.; Wilson, W.K. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). pp L13/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Strains measured during cyclic loading of notched members are compared with elastic-plastic finite element analysis to study the effect of cycle dependent softening or hardening, and also to demonstrate a simplified procedure for handling loads which vary irregularly with time, so as to avoid analytically following the load history on a reversal-by-reversal basis. Only time independent deformations are considered.

700 **Radiation damage in some EN steels.** Nandanpawar, M.; Rajagopalan, S. (Nagpur Univ. (India). Dept. of Physics). pp 785 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

701 **Metallographic investigation into interaction of cesium with some metals.** Sedel'nikov, V.A.; GodneVa, M.M. pp 56-65 of Issledovanie fiziko-khimicheskikh svojstv soedinenij redkikh ehlementov. Motov, D.L. (ed.). Leningrad; Nauka (1979). (In Russian)

.The corrosion effect of liquid cesium containing less than 0.01, 0.1 and more than 0.1% oxygen on Ag, Cu, Be, Al, Ti, Zr, Nb, Cr, Mg, W, Fe, V and Ni at 50-800 deg C has been investigated. Below 300 deg C no interaction between Cs containing less than 0.01% oxygen and Cu, Ti, Zr, V, Mo, W and Fe has been observed. At 300 deg C Zr and V display temper colours, and occasional pittings appear on Cu surface. At 50, 200 and 300 deg C respectively Be, Al and Nb form new phases. Silver dissolves starting from 50 deg C, nickel and chromium crack. At higher oxygen content (0.1%) oxide films appear on Ag, Be, Ti, Zr, Nb and Cr. Nb and V show intercrystallite corrosion. The tendency for cracking increases for all the metals. Cracks have been found on Ni, Cr, W, Al and Ti, while Cu at 800 deg manifests complete brittle failure.

## 3602 Ceramics, Cermets, And Refractories

*REFER ALSO TO CITATION(S) 163, 166, 204, 204, 217, 381, 419, 518, 519, 520, 521, 718, 1680*

702 (INIS-mf—6447, pp vp) **Studies of physical properties of plutonium dioxide powders.** Cuillerdier, C. (Compagnie Generale des Matieres Nucleaires (COGEMA), 92 - Chatillon (France)); Germain, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

703 (IWGFPT—7, pp 67-76) **Unconstrained swelling of $UO_2$.** Kauffmann, Y.; Morlevat, J.P.; Janvier, J.C.; Bruet, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Oct 1980. Dep. NTIS (US Sales Only).

From IAEA specialists meeting; Blackpool, UK (17 Mar 1980).

In the Tango experiments $UO_2$ 1 mm diameter microspheres were irradiated in the Siloe pool reactor in Grenoble. The main parameters are: (1) The initial density 10.11, 10.43, 10.78. (2) The temperatures from 900°C to 1500°C. (3) The burnup from 20,000 to 60,000 MWd t/sub U/$^{-1}$. 15 out of 27 batches of 300 particles were examined in hot cell. The aim was to determine the diameter increase during irradiation by a microradiography technique associated with an optical density analysis. A tentative correlation is done between swelling and total porosity. An evolution of three populations of pores has been measured and their different aspects have been shown by scanning electron microscope. Finally the stable fission gases residual concentration was determined for each batch irradiated up to 20,000 MWd t/sub U/$^{-1}$ by $\gamma$ counting the gases collected by an evaporation technique.

704 **Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites.** Davis, D.D.; Vance, E.R.; McCarthy, G.J. (Pennsylvania State Univ., University Park). pp 197-200 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

$Ca_{0.5}U_{0.5}PO_4$ can be synthesized in a neutral atmosphere or a closed system at ~ 1200°C by ceramic techniques and it forms complete solid solutions with $Ca_{0.5}Th_{0.5}PO_4$ and $NdPO_4$. Uranium appears to occur in monazite essentially in only the tetravalent state. The possible role of some other ions in monazite was also studied.

705 **Stability of pollucite in hydrothermal fluids.** Komarneni, S.; White, W.B. (Pennsylvania State Univ., University Park). pp 387-396 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Pollucite, $CsAlSi_2O_6$, a ceramic host structure for cesium was reacted with deionized water, with several solutions, and with several salt solutions under hydrothermal conditions at 100, 200, and 300°C. Pollucite is stable in the presence of deionized water under all conditions. Cesium can be extracted from pollucite by ion exchange at high activities of $Na^+$, $K^+$ and $Ca^{++}$. Solutions with high $Mg^{++}$ activity breakdown the pollucite structure with the concurrent precipitation of layer silicate.

706 **Advanced fuels for fast breeder reactors. A critical assessment of some phase equilibria.** Potter, P.E. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.); Spear, K.E. (Pennsylvania State Univ., University Park (USA). Materials Research Labs.). pp 195-226 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

In this paper are assessed critically six ternary systems of great significance to the preparation, fabrication and performance of advanced fuels for use in fast breeder nuclear reactors. The systems which have been considered are: U-C-O, Pu-C-O, U-C-N, Pu-C-N, U-N-O, Pu-N-O. All the systems are characterized by partial or complete solid solutions, and a major task of this assessment has been to develop simple models for these solutions which allow of consistency between the known thermodynamic and phase equilibrium data of the binary systems and the known condensed and gaseous phase equilibria of the ternary systems. Either ideal or regular solution models have been employed to describe the behaviour of the various solutions.

707 **Thermodynamic studies of thorium carbide fuel preparation and fuel/clad compatibility.** Besmann, T.M.; Beahm, E.C. (Oak Ridge National Lab., TN (USA)). pp 277-295 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The carbothermic reduction of thorium and uranium-thorium dioxide to monocarbide has been assessed. Equilibrium calculations have yielded Th-C-O and U-Th-C-O phase equilibria and CO pressures generated during reduction. The CO pressures were found to be at least five orders of magnitude greater than any of the other 15 gaseous species considered. This confirms that the monocarbide can successfully be prepared by carbothermic reduction. The chemical compatibility of thorium carbides with the Cr-Fe-Ni content of clad alloys has been thermodynamically evaluated. Solid solutions of $<ThNi_5>$ and $<ThFe_3>$ and of $<Cr_7C_3>$ and $<Fe_7C_3>$ were the principal reaction products. The Cr-Fe-Ni content of 316 stain-

less steel showed much less reaction product than that of any of the other six alloys considered.

708 **SYNROC research and development at Lucas Heights.** Reeve, K.D.; Ramm, E.J.; Woolfrey, J.L.; Ryan, R.K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Materials Div.). pp 243-247 of Austceram 80. Proceedings of the 9th Australian ceramic conference held at Sydney, August 1980. Sydney, Australia; Australian Ceramic Society (1980).

From 9. Australian ceramic conference; Sydney, Australia (27 Aug 1980).

This paper outlines work on the development of the ceramic waste form, SYNROC. The work involves fabrication studies, studies of the properties and behaviour of SYNROC minerals and systems and leach testing of SYNROC. The superior leach-resistance of simulated radwaste-doped SYNROC compared with borosilicate waste glass, particularly under hydrothermal conditions, has been confirmed.

709 **Austceram 80. Proceedings of the 9th Australian ceramic conference held at Sydney, August 1980.** Sydney, Australia; Australian Ceramic Society (1980). vp. (CONF-8008130—).

From 9. Australian ceramic conference; Sydney, Australia (27 Aug 1980).

Individual papers were indexed for inclusion in the Energy Data Base.

710 **Quadrupolar deformation of the electronic charge cloud and the lattice mechanics of LiH-LiD crystals.** Ghosh, S.; Basu, A.N. (Jadavpur Univ., Calcutta (India). Dept. of Physics); Sengupta, S. (Presidency Coll., Calcutta (India). Dept. of Physics). pp 662-668 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

As the deformable shell model incorporates both scalar and dipolar deformation, it is natural to expect that the quadrupolar deformation may be important in the case of lithium hydride, where the unstable hydrogen ion with its extremely loose bound outermost electron (compared to alkali halides) appears to be a plausible candidate for such deformation. Quadrupolar deformation in an ion in crystal may arise because of the variation of the electric field produced by o,.her ions over the extent of the charge cloud or due to a shortrange overlap effect of nearest neighbours. The second effect is much stronger than the first and this alone is considered in the present investigation. A method has been developed to obtain the relevant equations and evaluate all the lattice sums appropriate for the structure on the basis of an extended deformable shell model which incorporates scalar, dipolar and quadrupolar deformation. The quadrupolar deformation is found to have quite a considerable effect both on the dynamic and static properties of LiH-LiD crystals. The resulting model not only removes the discrepancies mentioned above but has also been successful in correlating the specific properties namely, the static lattice structure, the cohesive energy, the second order elastic constants, the dielectric properties and the lattice dynamics with a single set of parameters used for all of them. Only the shortrange overlap effect of the nearest neighbours has been taken into account and not that due to the variation of the electric field produced by other ions over the extent of charge cloud, since the former effect is much stronger than the latter one.

## 3604 Polymers And Plastics

*REFER ALSO TO CITATION(S) 835*

711 **Nuclear track production in solids.** Fleischer, R.L. (General Electric Co., Schenectady, NY (USA). Research and Development Center). pp 97-123 of Chalmers anniversary volume. Christian, J.W. (Oxford Univ. (UK). Dept. of Metallurgy); Haazen, P. (Goettingen Univ. (Germany, F.R.). Inst. fuer Metallphysik); Massalski, T.B. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)) (eds.). Oxford; Pergamon (1981).

Heavily ionizing nuclear particles produce radiation damage tracks in a wide variety of dielectric materials, ranging from crystals to glasses and high polymers. This article does not discuss applications, which were surveyed exhaustively in 1975 and updated recently. Rather the purpose is to consider the mechanism or mechanisms by which nuclear tracks are produced in solids. The plan here is to survey the phenomenology of track registration in solids: What particles produce tracks in what solids and under what circumstances. Next correlations are sought between particle registration and various possible criteria proposed for formation of tracks. Finally specific mechanisms are considered and recent relevant experimental results noted. Most of this review will be confined to ionization-related damage such as is produced by ions with energies above approximately 100 keV per atomic mass unit (amu). For low energies approximately 1 keV/amu, direct displacements are expected to dominate. This energy regime will not be discussed here.

## 3606 Other Materials

*REFER ALSO TO CITATION(S) 200, 201, 201, 202, 203, 205, 213, 215, 216, 217, 240, 317, 332, 333, 334, 335, 336, 337, 339, 360, 361, 362, 363, 364, 365, 366, 370, 372, 373, 376, 386, 387, 388, 432, 446, 448, 449, 835, 840, 916, 1387, 1654*

712 (INIS-mf—6449, pp vp) **Recombination in narrow-gapped semiconductors.** Herrmann, K.H. (Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik). 1980. (In German). Dep. NTIS (US Sales Only).

From 7. meeting physics and electronics; Berlin, German Democratic Republic (11 Feb 1980).

In narrow-gapped semiconductors of the type Hgsub(1-x)Cdsub(x)Te as well as in lead chalcogenides and their mixed crystals with energy gaps of some tenths of eV, the band-band recombination processes dominate if the samples are sufficiently perfect in their crystal lattices. The relative importance of the radiative or Auger recombination depends on the width of the energy gap and the charge carrier concentration. In the extreme case of very narrow energy gaps plasmon and one-electron recombination occurs additionally.

713 (INIS-mf—6449, pp vp) **Problems of producing homogeneously doped silicon by neutron irradiation.** Ross, R.; Zetzsche, A.; Hohmuth, K. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Forner, H.G.; Clauss, D.; Kessler, H. (VEB Spurenmetalle Freiberg (German Democratic Republic)). 1980. (In German). Dep. NTIS (US Sales Only).

From 7. meeting physics and electronics; Berlin, German Democratic Republic (11 Feb 1980).

Influences of reactor and material parameters on the homogeneity in resistance of neutron-doped silicon and on the induced radioactivity are discussed for doping silicon by thermal neutrons using the reaction $^{30}Si(n,\gamma)^{31}Si \rightarrow {}^{31}P$. Measures aimed at reducing undesirable influences and achieving high doping homogeneity and accuracy, are described. On the basis of experimental results it is shown that the irradiation facilities installed at the Rossendorf research reactor meet the requirements of production of high performance semiconductor materials.

714 **Durability of rhyolitic obsidian glass inferred from hydration dating research.** Ericson, J.E. (Harvard Univ., Cambridge, MA). pp 283-290 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Archaeological materials can provide important data for analyzing the processes of material degradation. Rhyolitic obsidian can

serve as a model of man-made glass which is used for containment of high activity nuclear waste. Natural obsidian hydration rates were determined using artifacts and archaeological data. This was followed up by inducing the hydration of the same source samples under controlled laboratory conditions. A comparison of the two data sets provides a model of the natural and induced processes. It appears that the diffusion coefficients of the laboratory results are very much less than those observed for natural hydration. This is interpreted to mean that laboratory conditions do not simulate well the processes present in the natural environment. The effective environment of obsidian is a complex of chemical and physical parameters, of which one is the inward diffusion of water. Obsidian is much more unstable than indicated by laboratory experiments. The intrinsic variables influencing the hydration rate are presented. Among them, CaO, $TiO_2$, density and $H_2O$ concentrations appear to be the most important variables.

715 **Nuclear waste glasses and volcanic glasses: a comparison of their stabilities.** Malow, G. (Hahn-Meitner-Institut fuer Kernforschung Berlin Gmbh, Germany); Ewing, R.C. pp 315-322 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The thermal and chemical stabilities of two borosilicate glasses and a glass ceramic are compared to those of three rhyolite glasses from northern California which are 500, 5000 and 670,000 years old. Thermal stability was evaluated by differential thermal analysis and heat treatments up to 100 days at 500° to 800°C. Samples were analyzed before and after heat treatment by means of optical and scanning electron microscopy, electron probe microanalysis and x-ray diffraction. Chemical stability was evaluated by leaching tests. Conclusions are as follow: (1) Naturally occurring volcanic glasses are more stable (chemically and thermally) than the three waste form glasses. (2) The greater stability of the volcanic glasses is due to their higher silica content which results in a higher temperature of formation. (3) Despite the range in ages, there was no apparent, time-dependent change in the alteration or devitrification among the three volcanic glasses. (4) To the extent that elevated temperatures (800°C) can be used to accelerate time-dependent reactions, the waste glasses show dramatic changes in degree of crystallinity and the formation of new phases, while the volcanic glasses show essentially no change. (5) As most volcanic glasses are less than 2 million years old, this suggests a maximum long-term stability of the waste glasses of not more than $10^6$ years. This comparison assumes ambient, surface conditions and does not take into consideration effects peculiar to the waste form and the waste repository (e.g., unique chemistry, radiation effects or the presence of brine solutions), which may reduce the long-term stability of the glass waste forms.

716 **Surface analysis: its uses and abuses in waste form evaluation.** McVay, G.L.; Pederson, L.R. (Pacific Northwest Lab., Richland, WA). pp 323-330 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Surface and near-surface analytical techniques are significant aids in understanding waste form-aqueous solution interactions. They can be beneficially employed to evaluate reaction layers on waste forms, to assess surface treatments prior to and after leaching, and to identify interactions with waste forms. Surface analyses are best used in conjunction with other types of analyses, such as solution analyses, in order to obtain a better overall understanding of reaction processes. In spite of all the benefits to be gained by using surface analyses, misinterpretations can result if care is not taken to properly obtain and analyze the data. In particular, the density variations through a reaction layer must be accounted for in both sputtering and data analysis techniques.

717 **Mechanisms for hydrothermal leaching of glass and glass-ceramic nuclear waste forms.** Altenhein, F.K.; Lutze, W.; Malow, G. (Hahn-Meitner-Institut fuer Kernforschung, Berlin, Germany). pp 363-370 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The very different chemical constituents contained in the waste glass lead to a specific leaching behavior under hydrothermal conditions. The results are still difficult to interpret in detail but the mechanism in deionized water resembles the one where a protective layer is formed by some of the glass constituents which determine the further release of material from the sample surface. Magnesium, Al, Zn, and Ti were found to contribute considerably to the layer formation in addition to waste constituents such as rare earths and U, Zr. The former elements have already been used for glass frit formulations in order to better digest the waste oxides. They might also be helpful, if used at appropriate concentration levels, to increase the leach resistance of the waste form.

718 **Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation.** Vance, E.R.; Pillay, K.K.S. (Pennsylvania State Univ., University Park). pp 413-420 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Various uranium-doped candidate phases for crystalline nuclear waste forms were made up by ceramic techniques and were reactor-irradiated to a dose of $\sim 10^{15}$ fission events.cm$^{-3}$. Structural effects were studied by powder x-ray diffraction. Monazite, xenotime, perovskite, zirconolite, huttonite, and zircon, all possible TRU-fixing phases, were all rendered amorphous, whereas MgO, $\alpha$-$Al_2O_3$, $Fe_2O_3$, $ThO_2$, $Y_2O_3$, and stabilized $ZrO_2$ were all apparently unaffected. It was concluded that fission fragment irradiation is probably not a good simulator of $\alpha$-recoil damage. However, a particular value of the results is that several candidate TRU-fixing phases can be readily made amorphous so the question of leachability and density differences of crystalline vs amorphous phases should be able to be settled.

719 **Metamictization by heavy ion bombardment of $\alpha$-quartz, zircon, monazite and nitride structures.** Cartz, L. (Marquette Univ., Milwaukee, WI); Karioris, F.G.; Fournelle, R.A.; Gowda, K.A.; Ramasami, K.; Sarkar, G.; Billy, M. pp 421-427 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

A host material for nuclear waste management needs to be stable to radiation damage effects. These studies have shown that the nitride compounds damage much less rapidly or not at all compared to silicate and other compounds with oxygen bonding. As a consequence, the nitride ceramics can be suggested as possible host materials.

720 **Geologic stability of monazite and its bearing on the immobilization of actinide wastes.** Floran, R.J.; Abraham, M.M.; Boatner, L.A.; Rappaz, M. (Oak Ridge National Lab., TN). pp 507-514 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

This paper examines the geologic evidence for monazite stability during weathering (i.e., at ambient T and P); under hydrothermal conditions (at elevated T and P); and with regard to radiation damage (metamictization). Recommendations are made for further research based on the available data.

721 **Development of transport and non-transport porosity in radiolytic graphite oxidation.** Blanchard, A. (UKAEA Springfields Nuclear Power Development Labs.). pp 134-140 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

In graphite moderated, carbon dioxide cooled, reactors, radiolytic graphite oxidation arises from the production of short lived energetic species and is confined to the internal porous structure. Exponential weight loss is possible as the volume of internal porosity, absorbing radiation, increases with time. Inhibitors are added to the coolant to minimise weight and hence strength loss. Carbon monoxide and methane are the principal gas phase inhibitors, competing with the graphite for the oxidising species. Methane has the further effect of producing a sacrificial layer at the pore wall. It follows from the mechanisms of inhibition that oxidation is reduced in the larger pores. In the small pores, the probability is high that oxidising species will reach the pore wall and exponential weight loss can occur until such time as the pores become sufficiently large for the inhibitors to operate. The results from a high weight loss experiment confirm this behaviour and allow predictions to be made with some confidence for other coolants - for which initial oxidation rate data are available. In this paper the results from an earlier weight loss experiment in an 'uninhibited', nominally pure, carbon dioxide coolant are assessed. Particular attention is drawn to the information which can be obtained from a study of transport properties as they develop with graphite weight loss. The objectives in understanding more exactly the process occurring inside the complex pore structure are to allow extensions in planned life, or greater flexibility in coolant plant operation and compatibility with fuel clad.

722 **Calculation of methane profiles in graphite structures.** Faircloth, R.L. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). pp 148-154 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The role of methane as an inhibitor of the radiolytic oxidation of the graphite moderator of an Advanced Gas Cooled Reactor (AGR) by the carbon dioxide coolant has been the subject of considerable study over the past decade. Although the exact mechanism of this inhibition process is not completely understood it is obvious that regions of the porous graphite structure remote from the surfaces directly accessible to the coolant can only be protected if in-depth penetration by the methane is possible. These in-pore mass transfer effects have been studied mathematically by equating the methane destruction rate with the rate of transport to and from the reaction site by means of both permeable flow and diffusion. More recently a numerical approach to the solution of the methane diffusion problem based on the FACSIMILE program for carrying out the relevant integrations has been adopted. This program has been written particularly to solve the mixed chemical, flow and diffusion problems which are typical of the kind occurring in the interpretation of AGR coolant chemistry. The advantage of a numerical technique such as this is that the solution method is quite general and may be applied to any type of radiolytic destruction term. Additionally, it is possible to solve for situations where parameters such as dose rate are a function of distance into the graphite phase and account may also be taken of the effect on the rate of the methane destruction process of changes in the water and carbon monoxide concentration produced within the structure as a result of this process. The model has recently been extended to cover this latter point and the resulting code is referred to as the MEDIC (MEthane DIffusion Calculation) program. The purpose of this paper is to describe briefly the assumptions made in the calculation and to highlight the more important conclusions.

723 **Influence of structure on the thermal oxidation of reactor graphites.** Stephen, W.J.; Swan, T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 174-180 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Graphite is used as a bearing and seal material at gas outlet temperatures in CAGRs under which condition it is subject to thermal corrosion. During thermal oxidation in $CO_2$-based gas mixtures most graphites exhibit an increase in reactivity. However the relation between structure and changes in thermal reactivity has received little attention, particularly in the nuclear context where the major oxidation reactions are radiolytic. The reactivity of a sample of graphite is a function of the amount and nature of the surface accessible to the gas. The variation in reactivity with weight loss therefore reflects changes in surface area and/or surface nature. The development of surface area is governed by changes in pore structure. It could be expected that the surface nature may be a function of material source and preparation. The purpose of this paper is to describe briefly an investigation of the relationship between reactivity, weight loss and structural changes for two Gilsocarbon based graphites.

724 **Investigation of nuclear grade graphite for possible sea-water contamination using a thermal oxidation technique.** Oxley, E. (British Nuclear Fuels Ltd., Annan). pp 181-188 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Subsequent to the ingress of sea-water (October 1977) into Hunterston Reactor 4, it was considered prudent to examine some graphite for possible contamination. A useful source of graphite for this examination was the fuel element sleeve. The fuel stringer 22/88 (Pechiney graphite), was discharged from Reactor 4 and despatched to Windscale for examination along with the fuel stringer 26/76 (BAEL graphite), previously discharged from Reactor 3. Windscale staff proceeded to take graphite samples from the inner and outer sleeves of fuel elements 1, 4 and 8, stored them in air and subsequently despatched them to Chapelcross for examination. It is well known that thermal oxidation of graphite with air, is extremely sensitive to contamination. Upon this premise the work programme was built. To confirm it a number of virgin graphite samples were contaminated with a sodium chloride solution, prior to oxidation. The irradiated material from Reactor 3 was to be used as a datum point. Since it had been subjected to a greater period of irradiation than the material from Reactor 4, it was anticipated to have a greater oxidation rate. The results are presented and discussed.

725 **Nickel-catalysed gasification of graphite by carbon dioxide.** Keep, C.W.; Terry, S.; Waite, R.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). pp 196-201 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

The effects of metal catalysts on the gasification of carbon have considerable technological importance and many studies of these effects have been carried out. The thermal reaction of carbon with $CO_2$ (the Boudouard reaction) is particularly important in nuclear reactors, especially if the high temperature graphite components have been contaminated by metallic catalysts such as nickel or iron. Several studies of the nickel-catalysed gasification of carbon by $CO_2$ have been made but the mechanism is, as yet, not clearly understood. This paper presents the preliminary results of a controlled atmosphere electron microscope (CAEM) study which is aimed at gaining more insight into this mechanism.

726 **Temperature dependant decay of metastable state of systems with large impurity-lattice relaxation ($CdF_2$:In).** Ogonowska, U. (Polska Akademia Nauk, Warsaw. Inst. Fizyki). pp 150-154 of New developments in semiconductor physics. Proceedings. Beleznay, F.; Ferenczi, G.; Giber, J. (eds.). Berlin, Germany, F.R.; Springer (1980).

From International summer school on new developments in semiconductor physics; Szeged, Hungary (1 Jul 1979).

This paper is a continuation of our papers, in which the configuration model of indium impurity in $CdF_2$ crystals was proposed and analysed. The main advantage of the present approach is incorporation of the two characteristic vibronic frequencies for the ground and excited states of the system. In a previous paper one effective frequency for both states was used.

727 **Dissolution of glass during irradiation by $^{60}$Co $\gamma$-rays.** Cousens, D.R. (Griffith Univ., Brisbane (Australia). School of Science). pp 135-141 of Austceram 80. Proceedings of the 9th Australian ceramic conference held at Sydney, August 1980. Sydney, Australia; Australian Ceramic Society (1980).

From 9. Australian ceramic conference; Sydney, Australia (27 Aug 1980).

The effect of irradition by $^{60}\gamma$-rays during dissolution has been examined for two typical glasses in acid and alkaline aqueous solutions. Initial results indicate that $\gamma$-irradiation causes no significant change in the dissolution rate of the glass.

728 **Isotopic and crystallographic studies of alpha irradiated SYNROC minerals.** Ringwood, A.E.; Oversby, V.M.; Sinclair, W. (Australian National Univ., Canberra. Research School of Earth Sciences). pp 252-256 of Austceram 80. Proceedings of the 9th Australian ceramic conference held at Sydney, August 1980. Sydney, Australia; Australian Ceramic Society (1980).

From 9. Australian ceramic conference; Sydney, Australia (27 Aug 1980).

The effect of radiation on the structures of minerals proposed for radioactive waste immobilization has been investigated. A series of naturally occurring zirconolite specimens which have accumulated alpha doses ranging from 5 x $10^{17}$ to $10^{20}$ alphas per gram and several perovskite samples with alpha doses up to 2.6 x $10^{18}$ alphas per gram were examined. Two dating systems, $^{206}$Pb/$^{238}$U and $^{207}$Pb/$^{235}$U were compared to determine whether the minerals had retained all of their U and Pb and intermediate daughter products since the mineral first formed. The evidence indicates that the safety of SYNROC as a waste form will not be adversely affected by radiation damage before the highlevel wastes have decayed to safe levels.

729 **Low-energy ion source for p-type doping in MBE.** Park, R.M.; Stanley, C.R. (Glasgow Univ. (UK)); Clampitt, R. (Oxford Applied Research Ltd., Witney (UK)). pp 235-240 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A compact low-energy ion cell has been developed for use as a source of acceptor impurities for the growth of p-type semiconductor material in ultra-high vacuum by molecular beam epitaxy. A flux of either zinc or cadmium atoms is emitted under molecular effusion conditions and partially ionised in the orifice of the cell by electron bombardment. The design provides for control of both the ion energy and current at constant cell temperature. (100)InP has been grown by MBE in a flux of 1 keV Zn ions. The surface morphology and crystal structure show no degradation when compared with (100)InP grown without the Zn ions present.

730 **Influence or preparation methods on structural integrity of Na-A and Na-$\alpha$ zeolites and on occlusion of aluminum compounds studied by H-NMR of sorbed water and ammonia.** Basler, W.D.; Maiwald, W. (Hamburg Univ. (Germany, F.R.). Inst. fuer Physikalische Chemie). pp 437-442 of Magnetic resonance in colloid and interface science. Fraissard, J.P.; Resing, H.A. (eds.). Dordrecht, Netherlands; Reidel (1980).

From 2. international symposium on magnetic resonance in colloid and interface science; Menton, France (25 Jun 1979).

By pulsed H-NMR various Na-A zeolites (Si/Al approx.1) and some Na-$\alpha$ zeolites (Si/Al between 1.48 and 2.58) have been studied freshly crystallized and after degassing and reloading with water and ammonia. In all Na-A samples there are OH-groups of occluded aluminum compounds, most of it in the $\beta$-cages. Amount of OH-protons and their exchange rate with the molecule protons in the $\alpha$-cages differ with conditions of preparation. Na-A grown in high alkali concentrations probably has non-integer sodalite units. It seems impossible to crystallize Na-A without any occluded aluminum nor can these compounds be removed by washing. In Na-$\alpha$ there are intact molecules in the $\beta$-cages and the exchange is slower than in Na-A. Both is independent of Si/Al-ratio.

731 **Corrosion of nuclear graphites with water vapor in helium.** Sasaki, Y.; Imai, H.; Nomura, S.; Kurosawa, T.; Fujii, K. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). pp 230-240 of Proceedings of the second U.S.-Japan seminar on HTGR safety technology, 1. General; accident delineation; helium technology. Tokai, Ibaraki; JAERI (Jun 1979).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

Graphites more than 10 brands were oxidized with water vapor in helium in order to select some favourable ones for the multi purpose experimental VHTR as well as to provide the basic corrosion data for its design. The reactions were carried out under well-defined conditions in a helium stream of total pressure of 1 atm. The corrosion behavior of irradiated graphite was studied in temperature range 800 - 1000°C at concentrations of water vapor between 3800 - 13000 vpm and the effect of high temperature irradiation was estimated on the reaction rate, its dependence upon temperature and also the order of the reaction. The chemical reactivity of graphite irradiated at 1000 +- 50°C increased linearly with neutron fluence up to 3.2 x $10^{21}$ n/cm$^2$. The activation energy for the reaction was found to decrease with neutron fluence for almost all the graphite, while that for a few graphites increased. The orders of the reaction were 1.0 for the irradiated graphite and 0.5 for the unirradiated one. Experiment was also performed under irradiation of Co-60 gamma ray to obtain the effect of irradiation on corrosion gas, which led a formation of active species of gas. The corrosion rates were found to be in the order of $10^{-9}$ g/g.hr at 1.2 v/o water vapor concentration at 30°C under the exposure rate of 1.25 x $10^6$ R/hr of gamma ray. The activation energy for the reaction was found to be about 1 kcal/mole in the temperature range 30 - 300°C. The influence of water vapor concentration for the reaction was scarcely observed in the range 0.6 - 2.3 v/o.

732 **Graphite oxidation by moisture.** Growcock, F.B.; Heiser, J.; Skalyo, J. Jr. (Brookhaven National Lab., Upton, NY (USA)); Chandra, D. pp 241-253 of Proceedings of the second U.S.-Japan seminar on HTGR safety technology, 1. General; accident delineation; helium technology. Tokai, Ibaraki; JAERI (Jun 1979).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

The nature of impurity iron in PGX graphite has been examined and its role during oxidation by steam has been clarified. The iron exists as mobile clusters which are accessible to $H_2$ and $H_2O$. It can be easily maintained in a reduced or oxidized state by variation of P sub($H_2$)/P sub($H_2O$). In the reduced state, iron is an active catalyst which can produce high localized rates of oxidation and form clearly defined etch pits.

733 **Deformable shell model study of the properties of CsCl.** Chakrabarti, S.K.; Sengupta, S. (Presidency Coll., Calcutta (India). Dept. of Physics). pp 645-653 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

The deformable shell model has been put to a stringent test by calculating the transition temperature for transition of CsCl crystal from the CsCl-to the NaCl-structure. Because of the very small heat of transition this calculation is a very sensitive test of the model. Einstein approximation is used for estimating the thermal part of free energy. The transition temperature has been obtained by equating the Helmholtz free energy for the two phases at transition since the volume change accompanying transition is very small and the transition takes place at atmospheric pressure. The static lattice energy expression used for computing the free energy is obtained from the effective interaction including the many body interaction. The equation of state has also been calculated using the relation -P = (deltaF/deltaV)sub(T), as a further test of the validity of the model. Finally, the same model has been used to improve upon the lattice dynamical calculation by incorporating the effect of the polarizability of $Cs^+$ ion on the phonon dispersion curves. The nearest neighbour distance at room temperature and at transition point in the CsCl-phase comes out within 0.1% of the experimental values. These have been determined for any particular temperature by minimizing the Helmholtz free energy at that temperature. The transition temperature has been reproduced almost exactly and in the calculation of the equation of state, the agreement with experiment is within 8% even at the highest compression. It has also been found that the inclusion of the positive ion polarizability improves the phonon dispersion curves of Ghosh and Basu remarkably with relatively a few number of parameters. The only remaining notable discrepancy is reported at the zone boundary along (110) direction for both the L.O. and T.O. branches and those too are found to be 5.2% and 4.6% respectively.

734 **Shortrange three-body interaction and the lattice statics and dynamics of CuI crystal.** Ghosh, A. (Presidency Coll., Calcutta (India). Dept. of Physics); Basu, A.N. (Jadavpur Univ., Calcutta (India). Dept. of Physics). pp 654-661 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

All the relevant equations for the three-body interaction for a cubic structure without a centre of symmetry have been developed, with a view to study the lattice statics and dynamics of the CuI crystal. It is noted from the results that the three-body interaction has quite a pronounced effect of the different properties. The sources of the remaining discrepancy are also discussed.

735 **Polarisable dipole models for ionic solids and their quantum mechanical justification.** Basu, A.N. (Jadavpur Univ., Calcutta (India). Dept. of Physics); Sengupta, S. (Presidency Coll., Calcutta (India). Dept. of Physics). pp 669-674 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

Polarizable Dipole models for ionic solids and their quantum mechanical justification are discussed at length. A self energy term and a term that symbolises all the energy that depends upon overlap intergrals - require certain assumptions that distinguish one dipolar model from the other. And hence, any quantum mechanical justification of a particular dipolar model has to explain these additional assumptions. This crucial assumption of SM has been tested on the basis of a direct quantum mechanical calculation, which clearly brings out the precise justification as well as the limitation of SM. Concurrently with this calculation the assumptions of DDM are also discussed. The essential step consists of evaluating the change in overlap energy between two ions in presence and absence of the dipolar deformation in any one or both of them. The calculations have been carried out using the statistical expression for energy as a function of charge density. Use has been made of the Hartree-Fock wave functions of the free ions for the two crystals investigated, namely, NaCl and KCl. The main results that emerge out of the calculations are summarized as (a) the form of the overlap interaction between polarised ions suggested by SM is only approximately correct; (b) the present calculation suggests a modified form of short range polarisation mechanism of which SM-mechanism is a particular case; (c) this is a new method of evaluating the coulomb overlap interaction and (d) using the free ion H-F wave functions alone it has been possible to calculate the static and dynamic properties of an ionic crystal without using any crystal property.

736 **Potential model for covalent crystals.** Sarkar, S.K.; Sengupta, S. (Presidency Coll., Calcutta (India). Dept. of Physics). pp 686-691 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

A unified study of the static and dynamic properties of covalent crystals such as cohesive energy, equilibrium, elastic constants, variation of bulk modulus with pressure, the dispersion curve covalent bonding is presented. The well known two-body central Morse potential is taken to act between nearest neighbours. In addition, a three body interaction of Keating type is taken which depends on nearest neighbour distance and bond angles. For diamond the scheme works well; an agreement within 15% is achieved. However, for Si, Ge and α-Sn while the agreement for all the properties are good the characteristic flatness and low value of transverse accoustic (TA) frequencies near the zone boundary (z.b.) are not reproduced. Since z.b. Ta frequency depends on three body interaction parameter it is made wave vector dependent. A suitable wave vector dependence of the parameter reproduces the flatness. However, the agreement at certain wave vector are worsened e.g. at z.b. in (111) direction maximum error of the order of 30% occurs for LA mode. Since diamond is different from the other three, such a wave vector dependence is not introduced.

737 **Irradiation experiment with a large graphite block.** Cords, H.; O'Connor, M.; Kleist, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen); Zeisser, P. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). pp C2/5 (1) of Structural mechanics in reactor technology. Transactions. Vol. C. Analysis of reactor fuel and cladding materials. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From 5. international conference on structural mechanics in reactor technology (SMIRT-5). 9. international seminar and 2. international seminar on structural reliability of mechanical components and subassemblies of nuclear power plants and 2. international seminar on containment of fast breeder reactors (CONFABRE-2); Berlin, Germany, F.R. (9 - 21 Aug 1979).

738 **Concrete for PCRV's: Mechanical properties at elevated temperatures and residual mechanical behaviour after triaxial preloading.** Aschl, H. (Ingenieurbuero Aschl (A.), Muenchen (Germany, F.R.)); Moosecker, W. pp H1/4 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

During the lifetime of reactor vessels stress states will change as a result of changes in loading and heating, shrinkage and creep. For the design of prestressed concrete reactor vessels information is required about the behaviour of concrete under multiaxial short- and long-term loading at elevated temperatures. Therefore, tests were carried out at the Institut fuer Massivbau of the Techni-

cal University of Munich to study the properties of mass concrete under uniaxial loading at 353 K. Additionally, biaxial creep of concrete up to 368 K was investigated. Some of the uniaxial test specimens were sealed with a copper foil to avoid drying. The concrete contained calzite gravel. The thermal expansion coefficient of predried concrete was 9.5 x $10^{-6}$, of sealed concrete 13.6 x $10^{-6}$ and of unsealed concrete 13.2 x $10^{-6}$. The modulus of elasticity at 353 K (393 K) was reduced by 10 (13)% for sealed and by 15 (22)% for unsealed specimens. Total shrinkage deformations of heated concrete were 190 to 225 microstrains for sealed and 250 to 350 microstrains for unsealed specimens. Creep deformations were highly dependent upon temperature being about 3 times higher at 353 K for sealed and unsealed concrete.

739 **Ultimate strength criteria of concrete under biaxial and tri-axial loading.** Valente, G. (Rome Univ. (Italy). Istituto de Scienza della Costruzioni). pp H2/4 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. H. Structural engineering of prestressed reactor pressure vessels. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The possibility of using numerical method for the analysis of reinforced concrete structures is limited by the incomplete knowledge of the behavior of concrete under multiaxial stress states. While many experimental and theorectical investigations have been and are presently carried out to clarify this problem, an attempt is being made here to use the available experimental data to achieve an ultimate strength criterion apt to be used in an analytical model.

# 40 CHEMISTRY

*REFER ALSO TO CITATION(S) 158*

740 **Origins of optical activity in nature.** Walker, D.C. (ed.). Amsterdam, Netherlands; Elsevier Scientific (1979). vp. (CONF-7906227—).

From Origins of optical activity in nature; British Columbia, Canada (5 Jun 1979).

Separate abstracts have been prepared for individual items within the scope of the Energy Data Base.

## 4001 Analytical And Separations Chemistry

*REFER ALSO TO CITATION(S) 165, 212, 245, 246, 367, 681*

741 (INIS-mf—6423, pp vp) **Sodium sampling and impurities determination.** Docekal, J.; Kovar, C.; Stuchlik, S. (Vyzkumny Ustav Chemickych Zarizeni, Brno (Czechoslovakia)). Apr 1980. (In Czech). Dep. NTIS (US Sales Only).

From Seminar on equipment and techniques for testing properties of steels in liquid sodium; Ostravice, Czechoslovakia (22 Apr 1980).

Samples may be obtained from tubes built into the sodium facility and further processed or they are taken into crucibles, stored and processed later. Another sampling method is a method involving vacuum distillation of sodium, thus concentrating impurities. Oxygen is determined by amalgamation, distillation, or vanadium balance methods. Hydrogen is determined by the metal diaphragm extraction, direct extraction or amalgamation methods. Carbon is determined using dry techniques involving burning a sodium sample at 1100 deg C or using wet techniques by dissolving the sample with an acid. Trace amounts of metal impurities are determined after dissolving sodium in ethanol. The trace metals are concentrated and sodium excess is removed.

742 (KFTI—79-40, pp 35-36) **Determination of oxygen, carbon and nitrogen in calcium by the gamma activation method.** Antuf'ev, Yu.P.; Gorenko, A.F.; Ekhichev, O.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

Gamma-activation determination of oxygen, carbon and nitrogen in technical calcium is described. The method involves ($\gamma$,n) reactions of $^{16}O$, $^{12}C$ and $^{14}N$. To determine the concentration of the admixtures the activities of $^{15}O$, $^{11}C$ and $^{13}N$ have been compared with those of the reference samples (LAVSAN polyester, boron nitride and aluminium nitride). Upon irradiation the calcium samples have undergone surface cleaning by 20-30 sec. etching in concentrated hydrochloric acid. Because of the matrix activation and the presence of other admixtures the determination of oxygen, carbon and nitrogen requires their radiochemical isolation. The average concentrations of oxygen, carbon and nitrogen in six calcium samples have been 3x10sup(-1), 3x10sup(-3) and 7x10sup(-3) % wt.

743 (KFTI—79-40, pp 55-57) **Gamma activation analysis of organogenic elements in biologically active organometallic compounds.** Gorenko, A.F.; Ekhichev, O.I.; Krivonosov, G.A.; Severin, N.F. 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

Gamma-activation analysis of organogenic elements in biologically active organometallic compounds is considered. The optimum irradiation energy for separate determination of oxygen, carbon, nitrogen and phosphorus is 15,18 and 23 MeV. The concentration of the elements has been determined by comparison of activities of the samples to those of the standards. The best results of analysis have been obtained using the extraction of oxygen and nitrogen in a high-temperature furnace in helium atmosphere. The average concentrations are 42-48 % oxygen, 30-34 % carbon, 2-2.6 % nitrogen, 3-4 % phosphorus for different samples (as recalculated to the dry substances); the overall relative error being no higher than 5-10 %.

744 (Zfl-Mitt—32, pp 32-41) **Principles of isotopic analysis by mass spectrometry.** Herrmann, M. Oct 1980. Dep. NTIS (US Sales Only).

In FAO/IAEA - Interregional Training Course on the Use of $^{15}N$ in Soil Science and Plant Nutrition. Lectures.

The use of magnetic sector field mass spectrometers in isotopic analysis, especially for nitrogen gas, is outlined. Two measuring methods are pointed out: the scanning mode for significantly enriched samples and the double collector method for samples near the natural abundance of $^{15}N$. The calculation formulas are derived and advice is given for corrections.

745 **Extraction of Th(IV) and U(VI) by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media.** Horwitz, E.P.; Kalina, D.G.; Muscatello, A.C. (Argonne National Lab., IL). *Separation Science and Technology;* **16**: No. 4, 403-416(May 1981).

The extraction behavior of Th(IV) and U(VI) from nitrate media was studied using relatively pure dihexyl-N,N-diethylcarbamoylmethylphosphonate (DHDECMP). The data were compared with analogous measurements obtained with dibutyl butylphosphonate (DB[BP]). It was found that the extractant dependency is second power for U(VI) with both DHDECMP and DB[BP]. However, the extractant dependency for Th(IV) is third power for DB[BP] but varied from 2.5 to 2.0 power for DHDECMP depending on the total nitrate concentration. The K/ sub d/ data do not support the theory that DHDECMP is an effective chelating agent for actinide ions. Significant differences between DHDECMP and DB[BP] do appear in the extraction behavior of Th(IV) from 1 to 5 M $HNO_3$. These differences are explained by the ability of DHDECMP to buffer itself against the effects of $HNO_3$ by protonation of the amide group.

746 **Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media.** Horwitz, E.P.; Muscatello, A.C.; Kalina, D.G.; Kaplan, L. (Argonne National Lab., IL). *Separation Science and Technology;* **16**: No. 4, 417-437(May 1981).

The extraction behavior of selected transplutonium(III) and lanthanide(III) ions from nitrate solution was studied using relatively pure dihexyl-N,N-diethylcarbamoylmethylphosphonate (DHDECMP). The data obtained for Am(III) and Eu(III) using DHDECMP were compared with analogous measurements obtained with dibutyl butylphosphonate (DB[BP]) and in certain cases with dihexyl-N,N-diethylcarbamoylethylphosphonate (DHDE-

CEP). It was found that both the nitrate and extractant concentration dependencies were third power. The K/sub d/'s for Am(III) and for Eu(III) measured from low acid $LiNO_3$ solutions were similar for DHDECMP, DHDECEP, and DB[BP], thus giving no evidence for any significant chelation effect for DHDECMP. Significant differences among DHDECMP, DHDECEP, and DB[BP] are found for the extraction of Am(III) and Eu(III) from 1 to 5 M $HNO_3$. These differences are explained by the ability of DHDECMP (and to a lesser extent, DHDECEP) to buffer itself against $HNO_3$ by protonation of the amide group. The K/sub d/'s for Am(III) through Fm(III) and for La(III) through Lu(III) measured from $LiNO_3$ and $HNO_3$ using DHDECMP show a definite tetrad effect when plotted as a function of Z. The K/sub d/'s for the lanthanides generally decrease with Z whereas the K/sub d/'s for the transplutonium elements change very little with Z.

747 **Gas content measurements of irradiated coated particles using the PGA system.** Robbins, J.M.; Kaniah, M.J.; Long, E.L. (Oak Ridge National Lab., TN (USA)). pp 357 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

748 **Analysis of gamma-ray spectra. Chapter 3. Section 1.** Perlman, I. (Hebrew Univ., Jerusalem (Israel). pp 9-24 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

With the advent of high-resolution semiconductor γ-ray spectrometers, it became possible to analyze materials producing complex spectra without resorting to chemical separations. The practical consequence of this turn of events has been to open a new era in the acquisition of accurate analytical data which otherwise could not be obtained without great labor. This chapter is confined to a discussion of such spectra, in particular to a delineation of the sources of error in processing the raw spectral data.

749 **X-ray spectrometry. Chapter 3. Section 2.** Mantel, M.; Amiel, S. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). pp 25-42 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

Neutron activation of many elements results in the production of radionuclides whose decay is accompanied by emission of characteristic x-rays as a result of two nuclear decay processes: internal conversion and orbital (K or L) electron capture. By measuring the energy and the intensity of these characteristic x-rays, the parent element may be identified and quantitatively evaluated.

750 **Neutron counting in activation analysis. Chapter 3. Section 3.** Amiel, S. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). pp 43-52 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

The author reviews recent and current work on the development and use of neutron counting techniques for analysis. Nuclear reactions which lead to neutron emission and may be used for analytical purposes such as delayed neutron emission, photoneutron emission and the analysis of $^{6}Li$ and $^{18}O$ are discussed.

751 **Measurement of very short-lived nuclides. Chapter 3. Section 4.** Amiel, S.; Mantel, M. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). pp 53-70 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

The measurement of very short-lived nuclides (viz. half-lives of less than several seconds) for the determination of various elements by activation analysis is in itself, due to the very short time intervals involved, a nondestructive technique. The principal problems associated with the measurement of very short-lived nuclides are due to the very short time in which all steps in the procedure must be carried out. The very short irradiation time, the very rapid transfer times and the very short measurement time can be dealt with only by fully automatic operations. To allow an accurate analysis at practical sensitivity levels, specially built equipment is required. The authors present a description of the necessary equipment and discuss several applications.

752 **Specific counting techniques. Chapter 3. Section 5.** Peisach, M. (Southern Universities Nuclear Inst., Faure (South Africa)). pp 71-92 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

The author discusses (a) coincidence counting of positron annihilation radiation, (b) measuring beta-emitters by Cherenkov radiation, and (c) track etching techniques.

753 **Prompt techniques. Chapter 3. Section 6.** Peisach, M. (Southern Universities Nuclear Inst., Faure (South Africa)). pp 93-111 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

Writing A(n,b)B as the generalised formulation of a neutron-induced reaction on a target nuclide A to yield a product nuclide B, radioactivation analysis is, in principle, only possible if B is radioactive, or is used to induce other reactions resulting in radioactive products. The analysis then proceeds some time later through the measurement of the emissions of radioactive decay, the rate of which is determined by the half-life of B. By contrast, prompt analysis depends on the measurements of one or more of the products b, emitted during the reaction, and only rarely does the stability of B affect the analysis. The time during which the prompt products are emitted may be picoseconds or less, but this value, though chosen arbitrarily, serves to distinguish clearly between the two approaches to nuclear analytical chemistry. The prompt techniques for reactions induced by neutrons are discussed.

754 **Manual and computerized data processing in activation analysis. Chapter 4.** Yule, H.P. (NUS Corp., Rockville, MD (USA)). pp 113-137 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

Activation analysis is a multistep process. The author considers result computation which is one step in the analysis. Both manual and computer calculations are discussed for each of the two major detection systems utilizing NaI(Tl) or Ge(Li) detectors.

755 **Biomedical sciences. Chapter 5. Section 1.** Parr, R.M. (International Atomic Energy Agency, Vienna (Austria)). pp 139-174 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

In this review the author describes the main characteristics of nondestructive neutron activation analysis as presently applied in the biomedical sciences, particularly in the light of developments since 1965, and reviews typical applications of the technique in clinical medicine and research, toxicology and public health, and animal and plant studies.

756 **Geo- and cosmochemistry. Chapter 5. Section 2.** Goles, G. (Oregon Univ., Eugene (USA)). pp 175-186 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

The author reviews applications of nondestructive activation analysis to problems in geochemistry and cosmochemistry. The main focus is on instrumental neutron activation analysis (conventionally termed INAA) using reactor sources.

757 **Applications of trace element analysis to studies of the atmospheric environment. Chapter 5. Section 3.** Winchester, J.W. (Florida State Univ., Tallahassee (USA); Desaedeleer, G.G. (Louvain Univ. (Belgium). pp 187-236 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

The authors present brief discussions of several important problem areas in environmental science, followed by specific examples of research using activation analysis, and in some cases related analytical techniques. Most of the examples deal with applications to the atmospheric sciences and interactions between the atmosphere and the fresh and salt water bodies of the earth's surface.

758 **High purity materials, standards, and reference materials. Chapter 5. Section 4.** Becker, D.A.; Rook, H.L.; LaFleur, P.D. (National Bureau of Standards, Washington, DC (USA). pp 237-258 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

The authors review the use of nondestructive neutron activation analysis for determining trace impurities in high purity materials. They then consider the use of standards and reference materials.

759 **Applications to archaeology. Chapter 5. Section 5.** Perlman, I. (Hebrew Univ., Jerusalem (Israel). pp 259-279 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

Neutron activation analysis, among analytical techniques, has certain capabilities which are virtually unique. It so happens that archaeology has pervasive and important analytical problems for which the liabilities of NAA are not of great concern, whereas its assets are crucial. The applications referred to are concerned with determining the places of origin of certain classes of ancient artifacts, primarily pottery.

760 **Forensic applications. Chapter 5. Section 6.** Yellin, E. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). pp 281-302 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

Modern scientific technology now plays an increasingly important role in the process of law enforcement. Neutron activation, as developed for elemental analysis offers, in many cases, the suitable answer to forensic problems. The author discusses the use NAA has been put to in forensic science.

761 **Tables of gamma-ray peaks observed in reactor neutron activation analysis. Appendix. Chapter 6.** Yule, H.P. (NUS Corp., Rockville, MD (USA)); Grimm, C.A. (National Bureau of Standards, Washington, DC (USA)). pp 321-360 of Nondestructive activation analysis. With nuclear reactors and radioactive neutron sources. Amiel, S. (ed.) (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Amsterdam, Netherlands; Elsevier (1981).

Analysis of Ge(Li) detector spectra, acquired in the course of reactor neutron activation analysis, involves identification of spectral components. This procedure is usually begun by comparing observed peak energies against a list of known spectral peaks to determine those isotopes which might contribute to the observed spectrum. Once contributors are tentatively identified, a list of peaks ordered by isotope is consulted to confirm or deny the presence of a tentative contributor. The success of this process depends on the completeness and accuracy of the tabulations, as well as on the results of analysis of the energies and intensities of spectral peaks. The authors have attempted to provide a sufficiently complete and accurate list of both gamma-ray peaks and prominent artifact peaks, using the latest available literature.

762 **Fluorescent X-ray spectroscopic analysis using radioisotopes.** Kang, Y.H.; Lee, Y.H. (Kyungpook National Univ., Taegu (Republic of Korea)). pp 299-303 of Research review of Kyungpook University. Special edition in commemoration of the sixtieth birthday of Dr. Suh Ton-Kak. Daegu, Korea; Kyungpook National Univ. (Aug 1980). (In Korean)

X-ray fluorescence techniques employing radioisotope sources to stimulate characteristic X-ray emission and non-dispersive method of X-ray energy selection and its measurement are described. This fluorescence analysis was carried out with $(Sr + Y)^{90}$ as primary X-ray source. For spectroanalysis, NaI(Tl) scintillation detector, pulse height analyzer, X-ray filter are applied. Pulse analysis technique was applied to glass and point. It appeared very typically as described. Pb-Sn alloy and $Na_2WO_4$, $BaCl_2$, $CuSO_4$, solution were analysed with Al(lmm) filter. Accuracies of the analysed solution were 0.02% for 1-10% $CuSO_4$, 0.05% for 5-15% $Na_2WO_4$ and 0.05% for 2-10% $BaCl_2$ in counting time of few minutes.

763 **Mass spectrometry.** Morrison, G.H. pp 201-229 of Elemental analysis of biological materials. Current problems and techniques with special reference to trace elements. Vienna, Austria; IAEA (1980).

The applicability of spark source mass spectrometry, isotope dilution mass spectrometry, and secondary ion mass spectrometry to the determination of trace elements in specific biological materials is assessed. Theory and scientific principles of these spectrometric techniques and methods of sample preparation are presented. Spark source mass spectrometry is particularly useful for simultaneous trace analysis for survey purposes. It is possible to determine more than 33 elements in biological samples with high sensitivity and with accuracies and precisions of the order of +- 10% or better. Isotope dilution mass spectrometry is primarily used in the determination of selected trace elements in biological samples with high accuracy and precision of the order of +- 0.1%. Seconardy ion mass spectrometry shows considerable potential for studying the distribution of trace elements in biological tissue and allows the determination of many elements in the ppM range.

764 **Instrumental effects in the application of static mass spectrometry to high-sensitivity carbon isotope measurements.** Fallick, A.E.; Gardiner, L.R.; Jull, A.J.T.; Pillinger, C.T. (Cambridge Univ. (UK). Dept. of Mineralogy and Petrology). pp 309-317 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

A description is given of the determination of the isotope ratios of carbon isotopes, using a static mass spectrometer; some of the limitations involved are outlined; and areas are indicated where advances and improvements are expected in the future. The subject is discussed under the headings: multiplier effects; gas degradation effects.

765 **Mass spectrometric isotope dilution analysis of trace amounts of halides.** Heumann, K.G.; Baier, K.; Beer, F.; Kifmann, R.; Schindlmeier, W. (Regensburg Univ. (Germany, F.R.)). pp 318-324 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

The subject is discussed under the headings: mass spectrometric measurements; isotope dilution analysis of halides; chloride and bromide trace analysis.

766 **Hydrogen isotope analysis by low resolution mass spectrometry.** Schott, R.; Beau, G. (CEA BP 14, Is-sur-Tille (France)). pp 337-341 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

The subject is discussed under the headings: exchange reactions (between mixtures of $H_2$, $D_2$, $T_2$ in the gaseous phase); mass spectrum (table of ions produced; steps in the calculation of quantitative results); calibration of mass spectrometer; experimental results; error calculations.

767 **Comparison of mass-spectrometry and $\alpha$-counting in analysis of uranium and plutonium isotopes in environmental samples.** Irleweck, K.; Pichlmayer, F. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna). pp 1473-1479 of Advances in mass spectrometry. Volume 8B. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

The determination of trace amounts of U and Pu isotopes is of interest in environmental and personal monitoring programmes. Commonly after preconcentration and separation of the radionuclides a proper sample is prepared electrolytically and the measurements are performed by alpha spectrometry. Some investigations on uranium isotopic abundances and on plutonium fallout deposition in soil have been carried out in this way. It is impossible to distinguish between the isotopes $^{239}Pu$ and $^{240}Pu$ by alpha spectrometry, however, because their $\alpha$-energies are too close together. Such determinations can only be carried out by mass spectrometry. Specific Pu emissions, e.g. from nuclear production plants, can be discriminated from the global fallout level. Mass spectrometry is the more sensitive method for measuring long-lived nuclides compared with $\alpha$-spectrometry. In the case of soil analysis, however, Pu detection is obstructed by the high natural uranium content, usually in the range 0.2 to 2.0 ppm which exceeds the trace amounts of plutonium by several orders of magnitude. This work describes a chemical procedure which separates U/Pu sufficiently for alpha spectrometry as well as for mass spectrometry, and compares results of environmental analysis applying both methods.

768 **Low concentration spectroscopic standards by ion implantation.** Matus, L.; Opauszky, I.; Nyary, I.; Pasztor, E. (Koezponti Fizikai Kutato Intezet, Budapest (Hungary)). pp 1962-1965 of Advances in mass spectrometry. Volume 8B. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

Working in the field of spark source mass spectrometry (SSMS) and dealing with the determination of trace impurities in metals, standards are needed with different matrix and trace elements. Methods are required suitable for preparing metal standards of any matrix and trace impurities with known concentrations in the ppM range. Ion implantation seems to be suitable for this purpose. Standards for investigation by Auger spectroscopy and secondary ion mass spectrometry were prepared earlier by ion implantation. Analysis by a spark source mass mass spectrometer is usually carried out on bulk materials using electrodes made from the samples, preferably of 1 to 2 mm diameter and 10 mm length. To obtain electrodes of this shape metal sheets of the matrix (10 $\mu$m thick and 10 mm wide) were implanted and these were then rolled up. The rolled up pieces were compressed in polythene press forms of AEI. The implanted element was not homogeneously distributed in the sample prepared in this way; it was concentrated in layers at 10 $\mu$m distances. Two electrodes were prepared in each case and they were sparked between their ends. At higher values of exposure the comsumption of samples was large enough to obtain an average ion production; at lower values the beam chopper method was used to reduce the ion transmission of the instrument and increase the amount of material necessary for a single exposure. The mass spectrometric measurements were performed on an AEI MS 702R spark source mass spectrometer with photoplate detection. The darkness of the lines was measured by a densitometer. The results are given and discussed.

769 **Automated nuclear geophysical instruments.** Shamov, A.I.; Egiasarov, B.G.; Dolenko, A.V.; Kutilin, S.A.; Subbotin, V.N.; Afanasiev, A.G.; Peleganchuk, Yu.I. (Union Scientific Research Institute for Instrumentation, Moscow, USSR). pp 127-133 of Measurement for progress in science and technology. Volume 2. Proceedings of the 8th IMEKO congress of the International Measurement Confederation held in Moscow, USSR, 21-27 May 1979. Solt, J.; Kemeny, T. (eds.). Amsterdam, Netherlands; North-Holland (1980).

From 8. IMEKO congress; Moscow, USSR (21 May 1979).

A number of nuclear geophysical instruments for a rapid control of a composition of various mineral raw and industrial materials, based on roentgen and radiometric, gamma-resonance, and other radiometric, gamma-resonance, and other methods are described. Main parameters of instruments as well as basic technical solutions are given.

770 **Analysis of uranium isotopic abundances by fine gamma spectrometry.** Philippot, J.C.; Bovard, P.; Pannetier, R. (CEA, IPSN, DPr, Laboratoire 501, Bois des Rames, Orsay, France). pp 487-494 of Measurement for progress in science and technology. Volume 2. Proceedings of the 8th IMEKO congress of the International Measurement Confederation held in Moscow, USSR, 21-27 May 1979. Solt, J.; Kemeny, T. (eds.). Amsterdam, Netherlands; North-Holland (1980).

From 8. IMEKO congress; Moscow, USSR (21 May 1979).

Fine gamma spectrometry has proved to be an ideal method for measuring uranium isotopes as they occur in various places especially since the appearance of the small new planar intrinsic Ge detectors with excellent resolution. The problems raised by this new metrology are discussed, in particular the experimental mastery of absorption phenomena, both in the sample and in the detector. These results are illustrated by three examples: analysis of a classic pitchblende, an Oklo ore sample, and a highly enriched industrial uranium.

771 **Investigation of the formation of atomic complexes in the spark ion source by the use of stable isotope tracers.** Cornides, I. (Central Institute for the Development of Mining, Budapest (Hungary). Mass spectrometry laboratory). pp 452-457 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

Although the existence of atomic complexes and/or complex ions in the vacuum spark, and also the consequent difficulties often encountered in trace analysis by spark source mass spectrometry (SSMS), have been known for a long time, neither the processes of formation nor the properties of these complexes have yet been satisfactorily investigated. The physical and chemical processes taking place in various gas ion sources have in most cases been thoroughly investigated and the results obtained used not only to improve the analytical performance, but also to acquire information about the processes themselves. Similar investigations of the spark ion source are highly desirable too, and may be successful if based on the advantageous features of the SSMS method (relatively high resolving power, considerable sensitivity), and on isotope ratio measurements instead of the less reproducible elemental analyses. A study of the processes in the spark by using stable isotope tracers obviously

seemed to be a promising undertaking. First, a study of the formation of aluminium oxide complexes was begun (with $^{18}O$ as tracer) and later the investigation was extended, by using electrodes containing $Sm_2O_3$ and $SmCl_3$ with $^{144}Sm$ as the tracer. Results are given and discussed.

772 **Quantitative analysis of III-V compounds, using low-energy ion-scattering spectrometry (ISS).** Barcz, A.; Croset, M.; Mercandalli, L.M. (Thomson-CSF, Domaine de Corbeville, 91 - Orsay (France)). pp 124-131 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

The results are reported of an ion-scattering spectrometry study of the surface and near-surface composition analysis of III-V semiconductors subjected to thermal stresses and/or ion milling. The concentration and matrix dependence of preferential sputtering, shadowing effect and neutralisation probability have been investigated with a probing beam of 2.5 keV $^{20}Ne^+$ and using $^{69}Ga$, $^{71}Ga$ and $^{75}As$ implanted into a number of substrates. As an application of the ISS method the near surface stoichiometry of heat-treated GaAs crystals was qualitatively measured and some quantitative analyses of III-V Gasub(x)Insub(1-x)Assub(y)Psub(1-y) samples and Gasub(1-x)Alsub(x)As multi-heterostructures were performed.

773 **High-precision automated beta/gamma technique for uranium ore analysis.** Sharland, C.J.; Robertson, M.E.A. (Scitec (Pty) Ltd, Sandton, South Africa); Brandt, P.J. (Anglo American Research Lab., Johannesburg, South Africa). pp 309-319 of Uranium evaluation and mining techniques. Proceedings of an international symposium jointly organized by the IAEA, the OECD NEA and the OAS Inter-American Nuclear Energy Commission and held in Buenos Aires, 1-4 October 1979. Vienna, Austria; IAEA (1980).

From International symposium on uranium evaluation and mining techniques; Buenos Aires, Argentina (1 Oct 1979).

A fully automated instrument has been developed (AURORA - Automatic Uranium Ore Analyser), which employs the beta/gamma technique for the analysis of uranium ore. The following parameters can be printed out: (a) Sample No.; (b) uranium concentration; (c) Ra/U equilibrium state; (d) $^{232}Th$ concentration; and (e) potassium concentration. The system once set up can be left unattended for the analysis of up to 100 samples at a time. The beta/gamma technique has the advantage over gamma spectrometric techniques in that it compensates for disequilibrium conditions such as radon loss and different Ra/U ratios. However, the accuracy obtained by early instrumentation was mediocre (+-25% above 1000 ppm uranium). With AURORA, the errors of early instruments have now been reduced to the stage where the accuracy obtained is comparable to XRF and chemical analysis. Other advantages are: the sample can be read immediately; simple and quick sample preparation; equilibrium state is given; and large sample mass (50 - 100 g) improves sampling statistics. The key features of the AURORA are: (a) The single detector is a stabilized CaF/NaI phoswich (phosphor sandwich) detector, with a high sensitivity to both betas and gammas; (b) Sample preparation consists of grinding to less than 100 mesh and filling the specially designed sample container; (c) A constant and efficient counting geometry is achieved by placing the detector directly beneath the base of the sample container; (d) Automatic corrections for density effects and thorium and potassium interferences; and (e) Systems operation and data analysis are controlled by a microprocessor, and accurate results are achieved with even low-grade ores. A manual version (GEMINI) has been developed for lower through put requirements.

774 **Relatively fast assay of Sr-90 by measuring the Cherenkov effect from the ingrowing Y-90.** Carmon, B.; Eliah, Y. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). pp 889-891 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A method is described for radioassaying $^{90}Sr$ from the ingrowth of the daughter product $^{90}Y$. It utilizes the Cherenkov radiation resulting within a liquid scintillator from the $\beta$-decay of $^{90}Y$ (max. energy 2.27 MeV). The gain and discrimination settings on the scintillation counter are adjusted to remove the contribution from the softer $\beta$-particles of the $^{90}Sr$ parent. Results are presented for the accuracy with which the $^{90}Sr$ activity can be estimated for activities in the range $10^{-5}$ to 0.15 $\mu$Ci and for time intervals of 1 to 7 days after separation. The lower limit of detection is about 3 x $10^{-6}$ $\mu$Ci at conditions of secular equilibrium (approximately 18 days after separation). A recommended procedure involving the use of $^{85}Sr$ as a tracer is given.

775 **Decontamination of tritiated water samples prior to tritium assay.** Carmon, B.; Levinson, S.; Eliah, Y. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). pp 892-894 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The liquid scintillation assay of tritiated water samples in radiation protection control is often inaccurate and unreliable due to the presence of other radionuclides. Various aspects of a simple and efficient separation procedure based on distillation and recovery of the tritiated water are investigated. The method was tried out on aqueous solutions of sixteen of the most common nuclides. Most of the radionuclides were absent from the distillate except for some traces of radioiodine, Hg-203 and Ru-103; decontamination factors of these nuclides are presented. The technique is especially useful in the tritium assay of liquid waste effluents from hospitals, biological and veterinary institutes and production facilities for labelled compounds.

776 **$^{230}Th$ assay by epithermal neutron activation analysis.** Kathren, R.L.; Desrosiers, A.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)); Church, L.B. (Reed Coll., Portland, OR (USA). Dept. of Chemistry). pp 923-926 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Thorium-230 is an important member of the U-238 decay chain and is a major contributor to the environmental dose from actinides. The use of epicadmium neutron activation analysis (NAA) as a simple, rapid, and inexpensive means of assaying $^{230}Th$ in biological systems is described. The suitability of the NAA method in the presence of the $^{238}U$ parent and other members of the natural uranium decay chain was examined by activating a quantity of various uranium ores with a reactor (TRIGA MK1) thermal neutron spectrum having a cadmium ratio of approximately 10. The resultant x-ray spectra in the region of 60 to 120 keV showed that the NAA method appeared feasible as a means of determining $^{230}Th$ in the presence of natural uranium. The data suggested a sensitivity of at least 10 ng. for a 10 g sample, 100 minute counting time, and epicadmium fluence of 3 x $10^{12}$ n/cm$^2$.

777 **Studies of forensic related trace elemental problems by the particle induced X-ray emission (PIXE) method.** Sen, P.; Mahapatra, D.P.; Panigrahi, N. (Institute of Physics, Bhubaneswar (India)); Rao, M.S. (State Forensic Science Lab., Bhubaneswar (India)); Verier, K.M.; Mehta, G.K.; Sen, S. (Indian Inst. of Tech., Kanpur. Dept. of Physics). pp 301 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

778 **Trace element concentrations in human hair: a study by instrumental neutron activation analysis.** Mangal, P.C.; Gulati, N. (Punjab Univ., Chandigarh (India). Dept. of Biophysics). pp 356 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

779 **Application of thermal ionization mass spectrometry in nuclear technology.** Mathews, C.K. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.). pp 41-54 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

The application of thermal ionisation mass spectrometers in nuclear science and technology as applied to the accurate isotope abundance measurements on most of the elements of interest in this field, such as uranium, plutonium, actinides, lithium, boron, magnesium and rare earths etc. is discussed. Also, the use of isotope dilution analysis for the measurement of the concentrations of these elements even at trace levels, in the fuel cycle is described. These applications of thermal ionization mass spectroscopy are discussed with examples taken from the work done at Trombay in areas such as fuel burn-up measurements, nuclear material accounting, half-life measurements and nuclear fission.

780 **Isotopic analysis of lithium, boron and magnesium and their importance in nuclear technology.** Chitambar, S.A.; Aggarwal, S.K.; Saha, B. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.). pp 62-68 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

The procedures developed and followed for determining the isotopic abundances of elements like lithium (used in fusion reactor technology), boron (used as a liquid poison in the Rajasthan Atomic Power Station reactors) and magnesium (used as a tracer for input accountability of plutonium in reprocessing plants) are described. The advantages of applying isotopic analysis for these studies are brought out. The high rates of precision obtainable (approximately 1%) are highlighted.

781 **Study of the instrumental and other aspects in the mass spectrometric analysis of deuterium content.** Jayaprakash, T.; Krishnan, M.S. (Bhabha Atomic Research Centre, Bombay (India). Heavy Water Div.). pp 88-96 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

Problems encountered in the isotopic abundance measurements of deuterium using a double collector mass spectrometer are described. Effect of change in ion source parameters on the $H_3^+$ formation and slope of measurement line is studied. Memory effect due to the cross contamination of samples of varying concentrations and effect of interference due to gases like nitrogen and helium in the hydrogen gas are also investigated.

782 **Isotopic analysis of water by mass spectrometry.** Vartak, D.G.; Unny, V.K.P.; Raval, M.N. (Bhabha Atomic Research Centre, Bombay (India). Reactor Chemistry Section). pp 102-106 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

The procedure used for analysis of water for its deuterium content at the Radiochemistry Labs of the Bhabha Atomic Research Centre, Bombay (India) is outlined. A short description of the mass spectrometer fabricated by the Technical Physics Division of the centre in 1960 for isotopic analysis of water is given along with the performance of the spectrometers. The usefulness of mass spectrometric analysis of water for its deuterium content in detecting small leaks of heavy water from reactor systems and in carrying out inventory of heavy water losses from systems of heavy water reactors has been stressed. Results of the performance tests of the modified version of the spectrometer newly fabricated by Technical Physics Division of BARC are also presented alongwith the accuracy and the precision of analysis obtainable with the instrument.

783 **Mass spectrometric analysis of deuterium in water.** Kapoor, S.; Dass, C. (Department of Atomic Energy, Kota (India)). pp 114-120 of Proceedings of the seminar on mass spectroscopy - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

Various analytical methods for the determination of deuterium concentration in water are reviewed and the importance of mass spectrometric analysis in the range of 10 to 10000 PPM is highlighted. The various mass spectrometric systems so far developed have also been described. Working experiences on a particular model of mass spectrometer with integral reduction facility are also presented.

784 **Mass spectrometric analysis of gaseous samples.** Vartak, D.G.; Prabhu, L.H.; Shah, G.C.; Menon, K.R. (Bhabha Atomic Research Centre, Bombay (India). Reactor Chemistry Section). pp 121-125 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

Use of a mass spectrometer for analysis of reactor cover gases like helium, nitrogen etc. for their impurities is explained. The instrument which is a 90deg sector type mass spectrometer has also been utilised for isotopic analysis of various solid, liquid and gas samples and methods used for treatment of the different types of samples before analysing on the mass spectrometer are discussed in detail. A method for analysis of mixtures of inorganic gases for their individual components including the preparation of standard samples and calibration of the spectrometer has also been included.

785 **New automated mass spectrometer for high precision isotope ratio determinations of gases.** Weibel, P.A. (Varian AG, Zug (Switzerland)). pp 128-132 of Proceedings of the seminar on mass spectroscopy - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

MAT's new MAT 250 mass spectrometer system which is intended for automatic precision analysis of isotope ratios in gases (H/D, $^{13}C/^{12}C$; $^{15}N/^{14}N$, $^{18}O/^{16}O$, $^{34}S/^{32}S$) is described in detail. The specifications and working procedure are explained. The performance and precision of the instrument are evaluated. Other application for which the automated mass spectrometer can be used are mentioned along with the advantages in its use. It is found that the MAT 250 features an exceptional performance far exceeding previous standards.

786 **New computerized mass spectrometer for isotopic analyses of solids.** Weibel, P.A. (Varian AG, Zug (Switzerland)). pp 133-136 of Proceedings of the seminar on mass spectroscopy - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

VARIAN MAT's new MAT 260 mass spectrometer system which is intended for automatic precision analysis of isotope ratios in solids (U, Pu, Rb, Sr, Pb and others) is described. The MAT 260 features exceptional performance for exceeding previous standards.

The programmable desk calculator and the exceptionally sensitive ion source which contribute to the excellent standard of the system are discussed. The specifications and the applications to which the system can be put are also discussed.

787 **TSN 206 SA thermal ionisation mass spectrometer and its applications to Oklo natural fossil reactor studies.** Le Goux, J.J. (Societe CAMECA, 92 - Courbevoie (France)); Trilokekar, M. (Gannon Dunkerley Ltd.). pp 17-20 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

The TSN 206SA Mass Spectrometer has been developed for both routine and research thermal isotopic analysis. Automatic data collection and processing control by a desk top calculator permit an increase of precision on isotopic ratios. A complete control is also available as standard for routine operation. An example of applications is illustrated by a summary of studies made on Oklo Natural Reactor by French Atomic Energy Center Laboratory in Saclay which is equipped with two TSN 206SA Mass Spectrometers.

788 **New thermal ionisation mass spectrometer.** Haines, C.; Merren, T.O.; Unsworth, W.D. (VG-Isotope Ltd., Winsford (UK)). pp 143-156 of Proceedings of the seminar on mass spectroscopy -applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

The Isomass 54E, a new thermal ionisation mass spectrometer for precise measurements of isotopic composition is described in detail. It combines the fruits of three development pro ects, viz. automation, energy filters and extended geometry with existing micromass expertise and experience. The hardware and software which are used for the automation as well as the energy filter used, are explained. The 'extended geometry' ion optical system adopted for better performance is discussed in detail.

789 **Automation of stable isotope analysis.** Moyes, H.J.; Leigh, D.; Unsworth, W.D. (VG-Isotopes Ltd., Winsford (UK)). pp 157-158 of Proceedings of the seminar on mass spectroscopy -applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

790 **Separation of elements by the electromigration method.** Stepanov, A.V.; Korchemnaya, E.K. pp 195-234 of Electromigration method in inorganic analysis. Moscow; Khimiya (1979). (In Russian)

Considered is the application of electrophoresis method for separation of alkali, alkaline-earth, transition metals, rare earth elements, actinoids, Cd, In, Te, Re, transplutonium elements, radioisotopes. A great attention is paid to clarifying the role of complexing agents in a separation process, their effectiveness estimation, ligand structure peculiarities stipulating the differences in the stability of complexes. Studied is the separation of elements by the electromigration method depending on the electrolyte nature, its concentration, stability of complexes.

791 (CEA-CETAMA—7, pp 1-3) **Analysis of zirconium and zirconium oxide. Hafnium determination by activation.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Nondestructive method of determination of hafnium in zirconium or zirconium oxide is described. With a 5 seconds' irradiation in a neutron flux of 4 x $10^{12}$n $cm^{-2}s^{-1}$ the method is applicable to at least 0.5 μg of hafnium.

792 (CEA-CETAMA—7, pp 1-4) **Plutonium analysis. Iron spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Iron determination in plutonium by dissolution in hydrochloric acid, reduction of iron from the valence III to the valence II with hydroxylamine hydrochloride and spectrometry of ferrous orthophenanthroline at 510 nm is described. The method is applicable for iron content from 150 to 1.600 ppm.

793 (CEA-CETAMA—7, pp 1-5) **Analysis of uranium and some uranium alloys. Aluminium spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Aluminium determination in uranium and U-Al-Fe alloy with 700 ppm of aluminium and 300 ppm of iron by dissolution in nitric-sulfuric acid and extraction of aluminium oxinate and spectrophotometry at 390 nm is described. The method is applicable for aluminium content between 200 to 5000 ppm.

794 (CEA-CETAMA—7, pp 1-5) **Analysis of uranium and some of its compounds and alloys. Silicon spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Silicon determination in uranium, uranium oxides ($UO_2$, $U_3O_8$, $UO_3$), ammonium diuranate, U-Al-Fe alloy (with 700 ppm of Al and 300 ppm of Fe) and UMo alloy (with 1.1 percent of Mo) by dissolution in nitric-sulfuric acid, formation of a silicomolybdate complex, reduction by ferrous sulfate and spectrophotometry at 820 nm is described. The method is applicable to silicon content between 10 to 1000 ppm.

795 (CEA-CETAMA—7, pp 1-5) **Analysis of uranium and some of its compounds or alloys. Silicon trace spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Silicon determination in uranium, uranium oxides ($UO_2$, $U_3O_8$, $UO_3$), ammonium diuranate, U-Al-Fe alloy (with 700 ppm of Al and 300 ppm of Fe) and U-Mo alloy (with 1.1 percent of Mo) by dissolution in nitric-sulfuric acid, formation of a silicomolybdate complex, and reduction by ferrous sulfate and spectrophometry at 820 nm is described. The method is applicable to silicon content between 5 to 50 ppm.

796 (CEA-CETAMA—7, pp 1-3) **Beryllium analysis. Chlorine turbidimetric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Chlorine determination in beryllium by dissolution in sulfuric acid, precipitation of silver chloride and turbidimetry at 350 nm is described. The method is applicable for chlorine content between 30 to 5000 ppm.

797 (CEA-CETAMA—7, pp 1-4) **Analysis of plutonium and its compounds. Uranium determination by fluorimetry.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Determination of uranium oxides in plutonium, plutonium oxides and plutonium fluorides by dissolution in hydrochloric acid, reduction of plutonium at the valence state III by hydroxylamine hydrochloride, plutonium separation on anionic exchanger and uranium fluorimetry after the general method is described. The method is applicable for uranium content between 10 to 1000 ppm.

798 (CEA-CETAMA—7, pp 1-5) **Analysis of uranium and of some of its compounds and alloys. Copper spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Copper determination in uranium, uranium oxides ($UO_2$, $UO_3$, $U_3O_8$), ammonium diuranate, U-Al-Fe alloy (700 ppm Al and 300 ppm Fe) and U-Mo alloy (1.1 percent Mo) by acid dissolution reduction of copper by hydroxylamine hydrochloride and formation of a complex with diquinolyle-2,2' amyl alcohol (pH value 6 to 7) and spectrophotometry at 550 nm is described. The method is applicable for copper content between 5 to 40 ppm in respect of uranium contained in the material.

799 (CEA-CETAMA—7, pp 1-4) **Analysis of plutonium and its nitric solutions. Boron spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Boron determination in plutonium or nitric acid solution of plutonium by dissolution in hydrochloric acid, plutonium separation on an anionic exchanger, formation of a complex boric acid-carminic acid in sulfuric solution and spectrophotometry at 585 nm is described. The method is applicable for boron content between 50 to 1000 ppm.

800 (CEA-CETAMA—7, pp 1-3) **Plutonium volumetric analysis after reduction by titanium tetrachloride.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Plutonium determination, particularly in nitric acid solutions, by reduction of plutonium, in nitric-sulfuric acid solution, from the valency state IV to the state III, by titanium trichloride and sulfamic acid and volumetric titration by ceric sulfate and ferrous orthophenanthroline is described.

801 (CEA-CETAMA—7, pp 1-5) **Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Impurity determination in zirconium oxide $ZrO_2$ is presented. The method can be used for zirconium, zirconium alloys or zirconium compounds (sulfates, nitrates...), after transformation in oxide but only, in this case, for non volatile elements during roasting As, Bi, Li, Mo, Zn are partially volatilized. The method is applicable for a total content in impurities lower or equal to 1 percent.

802 (CEA-CETAMA—7, pp 1-5) **Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Analysis method of solid sample or zirconium or alloys (zircaloys, zirconium-copper, zirconium-copper-molybdenum, zirconium-niobium) by an electric spark between the sample and a graphite or silver electrode is presented. Determination of impurity content is obtained by calibration curves.

803 (CEA-CETAMA—7, pp 1-6) **Water analysis. Radium determination by scintillation.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Radium determination in water by scintillation produced by alpha radiations emitted by radon is presented. The method is applicable for activity over $10^{-9}$ $\mu$Ci/ml.

804 (CEA-CETAMA—7, pp 1-3) **Analysis of uranium-containing solutions. Uranium VI spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Uranium VI determination in uraniferous solutions by extraction, with chlorobenzene of the complex uranium-PAN in alkaline medium and with EDTA and spectrometry at 560 nm is described. The method is applicable for uranium content between 2 to 80 $\mu$g.

805 (CEA-CETAMA—7, pp 1-6) **Analysis of uranium and its alloys. Thorium spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Thorium determination in uranium and uranium alloy by dissolution in hydrochloric acid, extraction of uranium, iron and zirconium by a long-chain amine, formation of the complex thorium-thorin in the aqueous phase and spectrophotometry at 545 nm is described. The method is applicable to thorium content between 0.4 to 250 ppm.

806 (CEA-CETAMA—7, pp 1-3) **Water analysis. Beta radioactivity indexes.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Beta radiation emission of an aqueous sample is compared to $\beta$ radiation emission of a calibrated source ($^{90}Sr + {}^{90}Y$ in radioactive equilibrium). Two conventional values, called beta radioactivity index of the soluble fraction and beta radioactivity index of the insoluble fraction, are determined. Particles of low energy, volatile products, absorption and retrodiffusion are not taken into account. The method is applicable to rainwater, surface waters and ground water, containing in solution from 0 to 500 mg of matter.

807 (CEA-CETAMA—7, pp 1-2) **Waste water. Radioactivity total determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Total radioactivity measurement of waste water is described. The method is applicable for activity higher or equal to $10^{-4}$ $\mu$Ci/ml. Volatile elements, radioelements emitting low energy beta or only gamma rays are not detected.

808 (CEA-CETAMA—7, pp 1-5) **Plutonium isotopic analysis by thermoionization mass spectrometry.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Description of an isotopic analysis method of plutonium in nitric acid solution applicable to any isotope content is presented.

809 (CEA-CETAMA—7, pp 1-4) **Uranium hexafluoride analysis. Inorganic impurities spectrographic determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Description of a method for determining impurities in uranium hexafluoride after its transformation to $U_3O_8$ is presented.

810 (CEA-CETAMA—7, pp 1-4) **Uranium tetrafluoride analysis. Silicon spectrophotometric determination.** [nd]. (In French). Dep. NTIS (US Sales Only).

In Analysis methods. (Revised methods).

Silicon determination in uranium tetrafluoride by pyrohydrolysis, dissolution in nitric and hydrofluoric acids, complexation of HF in excess by boric acid formation of the silicomolybdate complex, reduction and spectrophotometry at 815 nm is described. The method is applicable from 2 to 20 $\mu$g of silicon.

## 4002 Inorganic And Physical Chemistry

*REFER ALSO TO CITATION(S) 647, 834, 842, 849, 850, 851*

811 **Journees de calorimetrie et d'analyse thermique. (Meeting on calorimetry and thermal analysis).** Marseille, France; Association Francaise de Calorimetrie et d'Analyse Thermique ([nd]). vp. (In French). (CONF-7905199—).

From Meeting on calorimetery and thermal analysis; Marseille, France (10 May 1979).

Separate abstracts have been prepared for individual items within the scope of the Energy Data Base.

812 **High-temperature thermodynamic properties of aqueous sodium sulfate solutions.** Rogers, P.S.Z.; Pitzer, K.S. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **85**: No. 20, 2886-2895(1 Oct 1981). Contract W-7405-ENG-48.

A flow calorimeter has been used to measure the heat capacities of aqueous sodium sulfate solutions from 30 to 200°C at 1 bar, or the saturated vapor pressure, and at 200 bar. The heat-capacity data have been integrated as a function of temperature to obtain values of the apparent molal enthalpy, the osmotic coefficient, and the mean activity coefficient. Osmotic coefficients obtained in this manner are in good agreement with available literature data over the entire temperature range. These results indicate that heat-capacity measurements can be used reliably to obtain the high-temperature activity properties of electrolyte solutions, provided the enthalpy and Gibbs energy are known at 25°C.

813 **Heat capacity from 5 to 350 K and thermodynamic properties of cesium nitrate to 725 K.** Flotow, H.E.; O'Hare, P.A.G. (Argonne National Lab., IL (USA)); Boerio-Goates, J. (Michigan Univ., Ann Arbor (USA). Dept. of Chemistry). *Journal of Chemical Thermodynamics;* **13**: No. 5, 477-483(May 1981).

The low-temperature heat capacity (5 to 350 K) of $CsNO_3$ was determined by adiabatic calorimetry. No anomalies were observed in this temperature region, the curve of heat capacity against temperature having the normal sigmoid shape. These measurements yielded the reported values for the following thermodynamic properties at 298.15 K: C°sub(p), S°, (H°(T)-H°(0)) and (G°(T)-H°(0))/T. These measurements have been combined with published high-temperature heat capacities to give the thermodynamic properties of $CsNO_3$ to 725 K.

814 **$SrCl_2$ solubility in complex brines.** Clynne, M.A. (Geological Survey, Menlo Park, CA); Chou, I.M.; Haas, J.L. Jr. pp 499-506 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Brines containing dissolved $^{90}Sr$ and $^{137}Cs$ possess their own heat source. Thus, their migration could disturb the designed thermal evolution of a repository. In order to assess the problem better, a knowledge of the solubility of Sr and Cs in complex brines is necessary. This paper reviews known $SrCl_2$ solubility relationships in brines and bitterns and presents new experimental data for the system $SrCl_2$-NaCl-$H_2O$.

815 **Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes.** Strezov, A.S.; Mikhajlov, M.Kh.; Mikhajlova, V.Ts.; Taskaeva, M.I. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). pp 75-88 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

Regularity in the changes of the free energy, ΔG, enthalpy, ΔH, and entropy, ΔS, have been determined, a regularity that is associated with the complex-formation processes in metal-ligand systems whose stability constants of the consecutive mononuclear complexes ML, $ML_2$, $ML_3$, $ML_4$...MLsub(n) satisfy the relation: βsub(n)=A(asup(n)/n(n-1)...) for n=1, 2, 3...N, where βsub(n) is the overall stability constant of the MLsub(n) complex, n is the number of ligands ($1<=n<=N$), and A and a are constants. The validity of the above equation for a given metal-ligand system leads to linear dependences of the quantities A and a upon 1/T. This fact facilitates the calculation of the βsub(n) constants and their variation with temperature, and hence enables the determination of the changes of all thermodynamic functions with higher precision. The feasibility and utility of the above method are demonstrated by applying it to several metal-ligand systems.

816 **Thermodynamics of magnetite solubilization in basic medium.** Lambert, I.; Montel, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Beslu, P.; Lalet, A. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). pp 89-103 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980). (In French)

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The variations in magnetite solubility as a function of temperature and pH-value can be calculated from thermodynamic data relating to each of the species involved. To determine exactly the value of the free energy of formation of the species $HFeO_2^-$, solubility measurements were made in an autoclave at temperatures between 25°C and 300°C, in a $10^{-2}$N aqueous solution of potash. On the basis of these measurements the following value was obtained: $\Delta G°sub(HFeO_2^-)$ approximately equal to -88 kcal.mol$^{-1}$. These measurements also demonstrated the variation in the average size of magnetite crystals in relation to the experimental conditions and also the effect of size on solubility. For example, in an autoclave treatment at high temperature, solubility decreases with time and the crystals increase in size, whereas the opposite phenomenon occurs at ordinary temperatures. The rather poor effectiveness of efforts made to decontaminate a primary circuit during programmed coolings can be linked to these observations.

817 **Enthalpy of formation of YHsub(1.994) and YHsub(2.792).** Akhachinskii, V.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)). pp 155-160 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980). (In Russian)

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

Solution calorimetry has been used to determine the standard enthalpy of formation, ΔH°sub(f,298), of two hydrides of yttrium, the dihydride and a composition close to the trihydride. Yttrium and yttrium hydride were dissolved in 1.5M and 0.3M hydrochloric acid in a semi-microcalorimeter with an isothermal jacket. The composition of the dihydride was determined by the increase in the weight of the yttrium as a result of hydriding and the composition of the trihydride from the amount of hydrogen evolved during the dissolution.

818 **Calculability of multiple chemical interactions.** Fenyi, S.; Sundermann, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). pp 271-274 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

Chemical interactions are taken as a basis for calculating the equilibria and kinetics in multiple-component systems. Integration methods, the use of statistical solid-state and chemical models, and model-free thermodynamic relationships are discussed. The method used can be used e.g. in determining the dynamic behaviour of nuclear fuels or their interactions with the clad.

819 **Materials science issues encountered during the development of thermochemical concepts.** Mar, R. (Sandia Labs., Livermore, CA). pp 459-485 of Solar Materials Science. Murr, L.E. (ed.). New York, NY; Academic Press, Inc. (1980).

Materials problems are introduced that have been encountered during development of thermochemical concepts and schemes. The thermodynamics of reactions is discussed first, emphasizing those aspects which directly affect the selection of candidate reactions. Materials problems are then discussed in generic fashion; this discussion is broken down with the class of reaction as a common element. Then, a more detailed discussion of corrosion and catalyst development activities follows.

820 **Thermodynamic analyses of impure helium for HTGR material testing.** Noda, T.; Okada, M.; Hirano, H.; Yoshida, H.; Watanabe, R. (National Research Inst. for Metals, Tokyo (Japan)). pp 26-35 of Proceedings of the second U.S.-Japan seminar on HTGR safety technology, 2. Material properties and design methods; seismic research. Tokai, Ibaraki; JAERI (Jun 1979).

From 2. US-Japan seminar on HTGR safety technology; Fuji, Japan (24 Nov 1978).

Equilibrium oxygen and carbon potentials of experimental impure helium gases at 800°C and 1000°C were studied. The diagrams showing oxygen and carbon potentials of gas mixtures were presented. From the plots of atomic oxygen fraction, anti O/S against the difference between atomic oxygen and carbon fractions, (anti O-anti C)/S, the positions of oxygen and carbon potentials of

impure helium gases are schematically represented. (anti O-anti C)/S value gives a measure of the magnitude of oxygen and carbon potentials. The oxidation results of Inconel-617 in various impure helium gases could be explained by (anti O-anti C)/S values of the gases more reasonably than p sub($H_2O$)/p sub($H_2$) ratios of the gas mixtures.

821 **Thermal investigation into formatian of condensed phosphates in the $CeO_2$-$NH_4H_2PO_4$ system.** Vaivada, M.A.; Konstant, Z.A. (AN Latvijskoj SSR, Riga. Inst. Neorganicheskoj Khimii). pp 123-124 of Termicheskij analiz. Tom 1. Tezisy dokladov. Riga, USSR; Zinatne (1979). (In Russian)

From 7. all-union conference on thermal analysis; Riga, USSR (Apr 1979).

822 **Complex use of thermal analysis methods to study interaction of vanadium and titanium oxides with ammonium phosphates.** Gedrovits, Ya.Ya.; Konstant, Z.A.; Gol'dberg, Yu.Sh. (AN Latvijskoj SSR, Riga. Inst. Neorganicheskoj Khimii). pp 224-226 of Termicheskij analiz. Tom 1. Tezisy dokladov. Riga, USSR; Zinatne (1979). (In Russian)

From 7. all-union conference on thermal analysis; Riga, USSR (Apr 1979).

823 **Use of electromigration method in physicochemical investigations. Chapter 4.** Stepanov, A.V.; Korchemnaya, E.K. pp 103-193 of Electromigration method in inorganic analysis. Moscow; Khimiya (1979). (In Russian)

Presented are the basic results of experiments on studying the complexing of different metals (Sr, Cd, Nb, W, Te, Rh, rare earth elements, actinoids, etc.) with different ligands by the electromigration method. Tested are different ways of calculation of complex stability constants according to electromigration data. Attention is paid to the application of the method for studying equilibriums and kinetics of complexing, migration, hydrolysis and mobility of ions. Some physico-chemical properties of compounds are determined. Shown is the method applicability for studying isotope effects.

824 **Electrochemical properties of potassium heptafluoroniobate in chloride-fluoride melts.** Polyakova, L.P.; Polyakov, E.G.; Stangrit, P.T. pp 114-121 of Issledovanie fiziko-khimicheskikh svojstv soedinenij redkikh ehlementov. Motov, D.L. (ed.). Leningrad; Nauka (1979). (In Russian)

Cathodic processes in the KCl-KF-$K_2NbF_7$ melt have been studied by means of classical polarography, linear voltamperometry and potentiostatic electrolysis. Reduction of Nb at 700 deg C involves two stages, namely the recharging of pentavalent niobium into the tetravalent one at the potential -0.5 V and the discharge of the latter into niobium metal at -1.2 V with respect to silver reference electrode. Both stages are reversible.

## 4003 Organic Chemistry

*REFER ALSO TO CITATION(S) 103, 834, 850*

825 **Effect of surface pretreatment on the growth of carbon onto stainless steel from the decomposition of propane.** Keep, C.W.; Terry, S.; Gadsby, G.R. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). pp 40-44 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

A previous study on the decomposition of propane over nickel at 973 K has demonstrated that the formation of carbon deposits occurs, not from the cracking of propane, but from the cracking of unsaturated hydrocarbon products of its decomposition. These deposits were also found to be mainly filamentous in nature. These experiments have now been extended to include studies of the propane-stainless steel system, with particular reference to the effects of pretreating the steel with oxygen and carbon dioxide (upon the extent of carbon deposition).

826 **Secondary isotope effects on alpha-cleavage reactions.** Ingemann, S.; Hammerum, S. (Copenhagen Univ. (Denmark). H.C. Oersted Inst.). pp 647-650 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 Aug 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

Kinetic deuterium isotope effects on mass spectral reactions have in several instances been utilized to provide structural information and to answer mechanistic questions. Typically, the influence of the deuterium label on the rate of one of a number of competing reactions has been studied. Secondary isotope effects have usually been assumed to be relatively insignificant in comparison with the observed kinetic effects, even though various workers have shown that secondary isotope effects may indeed exert a considerable influence on the rates of competing simple cleavages. Recent studies have provided quantitative data to show that the mere presence of deuterium atoms up to six bonds away may influence the rate of a simple cleavage reaction. In relation to an investigation of rearrangements accompanying simple cleavage reactions, a semi-quantitative measure was needed of the variation of the secondary isotope effect with the number of bonds between the deuterium label and the point of rupture. The influence has therefore been examined of the presence of remote deuterium atoms on a typical simple cleavage reaction, the $\alpha$-cleavage of aliphatic amines. As a model compound, N-methyldipentylamine was chosen, systematically labelled with deuterium.

827 **Applications of isotopic labeling to the study of Friedel-Crafts reactions. Chapter 3.** Roberts, R.M.; Gibson, T.L. (Texas Univ., Austin (USA). Dept. of Chemistry). pp 103-145 of Isotopes in organic chemistry. Buncel, E. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Chemistry); Lee, C.C. (Saskatchewan Univ., Saskatoon (Canada)) (eds.). Amsterdam, Netherlands; Elsevier Scientific (1980).

A number of Friedel-Crafts processes that have been examined by the use of isotopic methods are considered: (1) the interaction of a Lewis acid with an acyl or alkyl halide; (2) the rearrangements of an alkylating species resulting from such an interaction, as observed in the arene products or in recovered starting materials; and (3) isomerizations of alkylation products which can occur in the presence of Lewis acids including (a) the alkylbenzene rearrangement (internal, of side chains), (b) disproportionation (intermolecular alkyl transfers), and (c) reorientations, which may be the results of either intra- or intermolecular processes.

828 **Aromatic cationic rearrangements. Chapter 4.** Williams, D.L.H. (Durham Univ. (UK)); Buncel, E. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Chemistry). pp 147-230 of Isotopes in organic chemistry. Buncel, E. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Chemistry); Lee, C.C. (Saskatchewan Univ., Saskatoon (Canada)) (eds.). Amsterdam, Netherlands; Elsevier Scientific (1980).

The role of isotopes in reaction mechanism studies of aromatic rearrangements is considered. The reactions discussed are all initiated by mineral acid or Lewis acid catalysts, and generally involve, as reactive intermediates, cationic species where the positive charge is located on a heteroatom of a functional group, or on a ring carbon atom.

829 **High-resolution spectroscopy of the 16-$\mu$m bending fundamental of $CF_4$.** McDowell, R.S.; Reisfeld, M.J.; Galbraith, H.W.; Krohn, B.J.; Flicker, H.; Kennedy, R.C.; Aldridge, J.P.; Nereson, N.G. (Los Alamos Scientific Lab., NM). *Journal of Molecular Spectroscopy;* **83**: 440-450(1980).

The 16-$\mu$m bending fundamentals ($\nu_4$) of $^{12}CF_4$, $^{13}CF_4$, and $^{14}CF_4$ have been observed at Doppler-limited resolution using a tunable PbSnSe semiconductor diode laser. The tetrahedral splittings of the rotational manifolds have been observed in all three branches, and in particular the dense and partially overlapping transitions in the Q branches have been resolved and assigned. A least-

squares fit of the Hamiltonian, including off-diagonal terms, yielded five scalar and three tensor spectroscopic constants for each of the three isotopes. From these constants the upper-state rotational constant $B_4$ and the Coriolis constant zeta$_4$ have been calculated, together with some of the other molecular constants. An absorption feature at about 0.18 $cm^{-1}$ to the red of the main Q branch of each isotopic species has been identified as the Q branch of ($\nu_2 + \nu_4$) - $\nu_2$, which is the transition that lases when $CF_4$ is pumped by a $CO_2$ laser at 9.4 $\mu$m (i.e., in $\nu_2 + \nu_4$).

## 4005 Photochemistry

830 **Dissociative ionization of water induced by single-photon vibrational excitation.** Natzle, W.C. (Lawrence Berkeley Lab., CA); Moore, C.B.; Goodall, D.M.; Frisch, W.; Holzwarth, J.F. *Journal of Physical Chemistry;* **85**: No. 20, 2882-2884(1 Oct 1981). Contract W-7405-ENG-48.

Vibrational photochemistry of pure liquid water to produce $H^+$ and $OH^-$ ions has been initiated by pulsed, single-photon excitation of overtone and combination transitions. The quantum yield at 283 +- 1 K varies from 2 x $10^{-9}$ to 4 x $10^{-5}$ for wavenumbers betwen 7605 and 18,140 $cm^{-1}$. The quantum yield rises through the low-frequency side of an absorption band and is relatively constant through the band center and high-frequency wing. The threshold for dielectric breakdown at 297 K is 20 GW $cm^{-2}$ for excitation at 7605 $cm^{-1}$.

831 **Kinetics of the reactions of the hydroxyl radical with xylenes.** Nicovich, J.M.; Thompson, R.L.; Ravishankara, A.R. (Georgia Inst. of Tech., Atlanta). *Journal of Physical Chemistry;* **85**: No. 20, 2913-2916(1 Oct 1981). Contract ER-78-S-05-6030.

Absolute rate constants for the reactions of the hydroxyl radical with o-, m- and p-xylene are reported for the temperature interval 250 $\leqq$ T $\leqq$ 970 K. Three major reaction pathways are observed. At T $\leqq$ 320 K, electrophilic addition of OH to the ring is dominant, while above 500 K abstraction of hydrogen atoms from the side-chain $CH_3$ groups is dominant. In the temperature range 320 to 400 K, the system is complicated because of the reverse decomposition of the addition product.

832 **Some gaseous reactions in carbon dioxide based coolants.** Falconer, J.W.; Hoare, D.E. (Dundee Univ. (UK)). pp 75-80 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

It has been shown that photolysis of $CO_2$ by light of 120 to 165 nm may be used as a source of $O(^1D)$ atoms. Competition between reaction of the $O(^1D)$ so produced with additives, and deactivation to $O(^3P)$ may be observed.

833 **Formation of two photoenols via a common pathway in the photochemistry of 2-methylbenzophenone.** Das, P.K.; Scaiano, J.C. (Univ. of Notre Dame, IN). *Journal of Photochemistry;* **12**: 85-90(1980).

18 references concerning the mechanism for the photochemical reaction of 2-methylbenzophenone in solutions are reviewed. A recently reported mechanism indicated that the cis- and trans-dienols formed by the photochemical reaction are produced via two independent pathways from the syn and anti-conformers of the ketone triplet. This reaction scheme is in direct opposition to other published mechanisms that led to the characterization of only one biradical which suggests that the two forms interconvert very rapidly with only one mechanism being involved. Experiments were performed, and the results are reported herein that confirm that there is interconversion of the anti-triplet state to the reactive syn-triplet state, that furnish evidence that there is only one biradical in similar systems, that indicate that the reaction is a radical-like process, and that point out that the assumption that both enols arise from a single biradical is totally meaningless. (BLM)

834 **Photoexcited states of organic anions.** Fox, M.A. (Univ. of Texas, Austin). *Chemical Reviews;* **79**: No. 3, 253-273(1979).

In this review attention is focused on the highly polarized organometallic compounds whose reactivity fits two characteristics: (1) the primary light absorption involves transitions within states associated with the organic portion of the molecule; and (2) ground-state thermal reactions parallel those which might be expected of the corresponding free anion. Organoalkali metal compounds receive major attention as meeting these two characteristics, and the organoalkali metal compounds are occasionally compared to other organometallics. The spectral properties of the anions of these compounds (and the structural conclusions that can be derived therefrom) and the photochemical reactions of these compounds (ranging from single electron transfer through geometrical isomerization to the more complex photochemical pericyclic reactions and stepwise bond-forming reactions) are the principal areas of interest. 279 references. (BLM)

## 4006 Radiation Chemistry

*REFER ALSO TO CITATION(S) 357, 358, 359, 361, 362, 363, 364, 366, 367, 719, 721, 722, 831, 1386*

835 (AERE-TP—843, pp 182-190) **Radiation damage in non-metals.** Stoneham, A.M. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Mar 1980. Dep. NTIS (US Sales Only).

In 25 years of theoretical physics 1954-1979.

Work on the problem of radiation damage in non-metals over the past 25 years is reviewed with especial emphasis on the contribution made at AERE, Harwell and in particular by members of the Theoretical Physics Division. In the years between 1954 and the end of the 1960's the main thrust in the radiation damage of non-metals was model-building including devising defect models and mechanisms that were qualitatively acceptable, and compiling systematic data. The early 1970's made greater quantitative demands as computer techniques made theory more powerful. In many cases it was possible to predict defect properties accurately, so that one could distinguish between different defect models which were hard to tell apart by experiment alone. In the late 1970's the most important aspect has moved towards mechanisms of defect processes, especially in cases where experiment by itself is limited by timescale, by complexity, by the unintentional impurities inevitable in real crystals, or by the extreme conditions required.

836 (INIS-mf—5673, pp 68) **Effect of ionizing radiation sterilization dose on some polysaccharides.** Grachev, S.A.; Shchelkunova, L.I. 1978. (In Russian). Dep. NTIS (US Sales Only).

From 1. all-union scientific--technical conference on medical production radiation sterilization; Moscow, USSR (24 Oct 1978).

837 **Radioracemization of amino acids. Chapter 4.** Lemmon, R.M.; Bonner, W.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). pp 47-52 of Origins of optical activity in nature. Proceedings of the symposium held in British Columbia on June 5-6, 1979. Walker, D.C. (ed.) (British Columbia Univ., Vancouver (Canada). Dept. of Chemistry). Amsterdam, Netherlands; Elsevier Scientific (1979).

From Origins of optical activity in nature; British Columbia, Canada (5 Jun 1979).

The authors show that optically active amino acids, both as solids and in solution, are racemized when exposed to $\gamma$ radiation. Quantitative values for this radioracemization as a function of ionizing-radiation dosage have been obtained. These values cast additional doubt on the validity of the Vester-Ulbricht hypothesis for the origin of optical selectivity in biomolecules. It is also found that the radiation doses to which meteoritic material has been exposed in outer space is enough to cause appreciable racemization of the amino acids. These findings render less secure previous conclusions concerning the presumed abiogenic origin of meteoritic amino acids.

838 **Bibliographies on radiation chemistry. 3. Formation and reactivity of the superoxide radical anion.** Greenstock, C.L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment); Ross, A.B.; Helman, W.P. (Notre Dame Univ., IN (USA). Radiation Lab.). *Radiation Physics and Chemistry;* 17: No. 5, 247-262(1981).

This bibliography lists about 400 papers dealing solely with the production and reactivity of superoxide radical anions in irradiated aqueous and organic liquids. Only papers dealing with quantitative mechanistic, spectroscopic or kinetic data have been included. The listing was prepared by searching the RCDC bibliographic data base with SELECT keywords $O_2^-$ or $HO_2$ and aqueous solution. The key words radicals (oxygen), peroxy radicals, pulse radiolysis, flash radiolysis, esr and gamma rays were also used. Additional relevant references were obtained from inspection of reviews, individual author indexes and cited references. The present bibliography excludes solid and gas phase studies, and also technical, government and in-house reports, theses, patents and some symposia proceedings. Several references prior to 1960 have been added, and the list should be reasonably comprehensive from 1965-1980. The listing is in chronological order, according to year of publication in the categories Photochemistry, Radiation Chemistry, Other, and Reviews.

839 **Mechanisms involved in radiolytic carbon deposition from $CO_2$/CO/$CH_4$.** Norfolk, D.J.; Skinner, R.F.; Williams, W.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 67-74 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

AGR coolant ($CO_2$ with controlled minor quantities of CO, $CH_4$ and $H_2O$) is chemically quite stable at reactor temperatures until it is irradiated. Of the many reactions which then occur only a few are likely to be important in deposition. The first step in analysing this is to group the reactions into chemical 'streams' originating in the destruction of a coolant component. Two streams involve intermediates known to be capable of forming carbonaceous deposit. The first is the oxidation of methane to CO and $H_2O$ via a number of hydrocarbon and oxygenated organic compounds. Although the proportion of $CH_4$ in AGR coolant is $< 0.05\%$, it is rapidly destroyed because it reacts with products of $CO_2$ radiolysis. Diversion of even a small fraction of this stream therefore produces significant deposition. The second stream is the direct radiolysis of carbon monoxide to give carbon suboxide ($C_3O_2$), which in turn can polymerise and degrade to deposit on hot surfaces. This stream is much smaller than the first because the radiation energy must be dissipated directly in the minor component; moreover $C_3O_2$-derived deposit is normally readily oxidised (though it does become less reactive as its formation temperature increases). Nevertheless, in principle sufficient CO is radiolysed to produce significant deposition in an AGR, and this stream cannot therefore be ignored.

840 **Radiolytic carbon gasification.** Shennan, J.V. (UKAEA Springfields Nuclear Power Development Labs.). pp 98-110 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

A vast body of knowledge has been accumulated over the past thirty years related to the radiolytic oxidation of the graphite moderator in carbon dioxide cooled Reactors. In the last ten years the dominance of the internal pore structure of the graphite in controlling the rate of carbon gasification has been steadily revealed. The object of this paper is to sift the large body of evidence and show how internal gas composition and hence carbon gasification is controlled by the virgin pore structure and the changes in pore structure brought about by progressive radiolytic oxidation.

841 **Radiolytic oxidation of methane in commercial advanced gas cooled reactors.** Pritchard, J.A.; Matthews, P.C. (Central Electricity Generating Board, Bristol (UK)); Palmer, J.E.M. (Central Electricity Generating Board, Barnwood (UK). Generation Development and Construction Div.). pp 239-247 of Gas chemistry in nuclear reactors and large industrial plant. Dyer, A. (ed.) (Salford Univ. (UK). Dept. of Chemistry and Applied Chemistry). London, England; Heyden (1980).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Measurements of the rate of $CH_4$ destruction in Hinkley Point 'B' AGR at different coolant compositions have indicated a higher CO concentration dependence than would have been expected from calculations based on previously used empirical expressions. The present results suggest much higher methane destruction rates at low CO concentrations. This has important implications on the sizing of the coolant control plant for future CAGRs and further tests may therefore be required to confirm the observed trend. If the comparatively simple expression for the $CH_4$ destruction rate as a function of coolant composition derived in this paper is confirmed, it should be possible to derive reasonable values for full power $CH_4$ destruction rates from measured data at lower powers, by a nuclear flux correction alone.

842 **Gas chemistry in nuclear reactors and large industrial plant.** Dyer, A. (ed.). London, England; Heyden (1980). vp. (CONF-8004154—).

From Conference on gas chemistry in nuclear reactors and large industrial plant; Salford, UK (21 Apr 1980).

Individual papers were abstracted and indexed separately.

843 **Asymmetric crystal seeding in the presence of beta particles. Chapter 16.** Kovacs, K.L. (Magyar Tudomanyos Akademia Biologiai Kutato Koezpontja, Szeged). pp 213-227 of Origins of optical activity in nature. Proceedings of the symposium held in British Columbia on June 5-6, 1979. Walker, D.C. (ed.) (British Columbia Univ., Vancouver (Canada). Dept. of Chemistry). Amsterdam, Netherlands; Elsevier Scientific (1979).

From Origins of optical activity in nature; British Columbia, Canada (5 Jun 1979).

The suggested link between elementary particle asymmetry and the origin of asymmetry of biomolecules has been investigated in the racemic conglomerate crystallization of over 1000 samples of D, L-sodium-ammonium tartrate. The effect of $^{32}$P beta irradiation on weight and optical activity of the crystalline phase, and crystallite size was measured. Irradiated samples yield more crystalline material than controls and the crystalline phase displays optical activity characteristic of the 'unnatural' L-isomer. The magnitude of the effect depends on the amount of added radioactivity. The crystallite size is also affected by the presence of $^{32}$P. The possible interference by optically active contaminants in the system has been examined and eliminated on the grounds of indirect evidence.

844 **Racemization and the origin of asymmetry of biomolecules. Chapter 17.** Keszthelyi, L.; Czege, J.; Fajszi, Cs.; Posfai, J. (Magyar Tudomanyos Akademia Biologiai Kutato Koezpontja, Szeged); Goldanskii, V.I. (Institute of Chemical Physics, Moscow, USSR). pp 229-244 of Origins of optical activity in nature. Proceedings of the symposium held in British Columbia on June 5-6, 1979. Walker, D.C. (ed.) (British Columbia Univ., Vancouver (Canada). Dept. of Chemistry). Amsterdam, Netherlands; Elsevier Scientific (1979).

From Origins of optical activity in nature; British Columbia, Canada (5 Jun 1979).

The role of racemization in the origin and amplification of the asymmetry of biomolecules is studied by a critical reevaluation of the main types of related models. Radioracemization is considered. The results suggest that the processes leading to 'perfect' optical purity and maintaining it have to be faster than the racemization, thus these regulatory processes should have arisen in the course of chemical or biological evolution within a much shorter time interval than the racemization time.

## 4007 Radiochemistry And Nuclear Chemistry

*REFER ALSO TO CITATION(S) 702, 1708*

845 (CONF-800608—(Vol.3), pp 23p, Paper 5) **Development of a low NO/sub x/ burner for utility boilers.** Mansour, M.N. (Southern California Edison Co., Rosemead, CA); Radak, L.J.; Sheppard, D.B. 1980. Air Pollution Control Association, P.O. Box 2861, Pittsburgh, PA 15380. Order Number DE81904081.

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

The body of information presented in this paper is directed to scientists and engineers involved in the control of NO/sub x/ emission from utility boilers. The paper describes the development of a low NO/sub x/ oil burner designed to achieve NO/sub x/ control through the optimization of burner design and operating variables rather than the use of conventional combustion modification techniques and costly post combustion treatment. The novel burner demonstrated during this program provided control over NO/sub x/ formation by both thermal fixation of atmospheric nitrogen and oxidation of organically bound fuel nitrogen. The burner development was carried out in a subscale 10 MMBtu/hr facility and a 45 MW utility boiler and was also demonstrated in a 750 MW boiler. The program showed that the level of mixing within the burner flame significantly influences NO/sub x/ emission. Intense mixing between combustion air and fuel invariably resulted in low excess $O_2$ operation and high NO/sub x/ emission. Low NO/sub x/ emission level was obtained, without sacrificing other operating requirements, by controlling the degree of fuel atomization and mixing within the burner flame and by providing localized quenching of the flame to maximize thermal NO/sub x/ control.

846 **Decontamination techniques suitable for post-irradiation examination caves.** Curren, W.D.; Bird, E.J.; Bond, R.D.; Green, I.S. (UKAEA Atomic Energy Establishment, Winfrith). pp 361-362 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Decontamination techniques have been developed for application to PIE facilities and associated equipment such as glove boxes and radioactive transport flasks. Decontamination is necessary to reduce gamma-dose before maintenance work is carried out, or to facilitate waste management by removing activity from items destined for disposal as active waste. An ideal decontamination process would be easily adaptable to remote operation, and would collect and concentrate the removed material into a small volume. Three techniques are illustrated: (a) chemical decontamination by circulation of solvents; (b) electrochemical decontamination by electrodeplating; (c) physical decontamination by high-pressure fluid jetting.

847 **Aqueous actinide complexes. A thermochemical assessment.** Fuger, J. (Liege Univ. (Belgium)); Khodakovskij, I.L. (AN SSSR, Moscow. Inst. Geokhimii i Analiticheskoj Khimii); Medvedev, V.A. (AN SSSR, Moscow. Inst. Vysokikh Temperatur); Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). pp 59-73 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The scope and purpose of an assessment of the thermodynamic properties of the aqueous actinide complexes are presented. This work, which at present is limited to inorganic ligands and three selected organic ligands (formate, acetate and oxalate), is part of an effort established by the International Atomic Energy Agency to assess the thermodynamic properties of the actinides and their compounds. The problems involved in this work are illustrated by discussing the present status of the assessment as related to a few complex species.

848 **Investigations on caesium uranates: VII. Thermochemical properties of $Cs_2U_4O_{12}$.** Cordfunke, E.H.P. (Stichting Energieonderzoek Centrum Nederland, Petten); Westrum, E.F. Jr. (Michigan Univ., Ann Arbor (USA). Dept. of Chemistry). pp 125-140 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The thermochemical properties of $Cs_2U_4O_{12}$ have been evaluated from new experimental data, including the low-temperature heat capacities, the enthalpy of formation at room temperature, and the high-temperature enthalpy increments by drop calorimetry. From the results a section of the Cs-U-O phase diagram at 1000 K has been constructed showing the stability of the compound as a function of caesium and oxygen pressure.

849 **Alkaline earth uranates. An exploration of their thermophysics and stabilities.** Westrum, E.F. Jr.; Zainel, H.A. (Michigan Univ., Ann Arbor (USA). Dept. of Chemistry); Jakes, D. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). pp 143-154 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

An investigation of the thermodynamics of the alkaline-earth monouranates and of magnesium triuranate has been undertaken. At the present time the low-temperature heat capacities of the alkaline earth monouranates $MgUO_4$, $CaUO_4$, $\alpha$-$SrUO_4$, and $BaUO_4$ as well as $MgU_4O_{12}$ have been examined by adiabatic calorimetry from 5 to 350 K, and supplemented by drop calorimetry to 900 K for $MgUO_4$. The work was undertaken primarily to ascertain the thermodynamic stability of these uranium compounds, which may be important from the point of view of reactor safety, and to provide a better understanding of the thermodynamics of ternary oxides. Relatively uncomplicated heat capacity curves were obtained. The entropies ($\Delta S°/R$) at 298.15 K of typical members are: $MgUO_4 = 15.87$, $CaUO_4 = 14.89$, $\alpha$-$SrUO_4 = 18.42$, and $BaUO_4 = 21.39$.

850 **Aqueous complexes of metal ions present in the reprocessing of nuclear fuels. Complexes with the ligands orthophenanthroline and dibutyl phosphate.** Musikas, C.; Le Marois, G.; Racinoux, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Div. de Chimie). pp 105-122 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980). (In French)

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The authors have studied the aqueous complexes formed by the ligands orthophenanthroline and dibutyl phosphate with the metal ions present in nuclear fuel reprocessing solutions. Orthophenanthroline forms the complexes $ML^{3+}$ and $ML^{3+}{}_2$ with the trivalent lanthanide and actinide ions. The stability of americium complexes is greater than that of the lanthanide ions of similar ionic radius. The Np(V) ions from a single complex, $NpO_2L^+$, whose stability is greater than that of the complex $AmL^{3+}$, contrary to what is normally observed. The dibutyl phosphate ions tend to form compounds of low solubility and having the formula M(DBP)sub(n) (where n is the charge on the metal cation). However, in the case of low and high ligand concentrations, one observes cation and anion complexes, respectively. Uranium forms the soluble complexes $UO_2(DBP)^+$ and $UO_2(DBP)^{2-}{}_4$. Neptunium(V) is very insoluble: the existence of two not very soluble species, $NpO_2(DBP).xH_2O$ and $NpO_2(DBP)_2Na.yH_2O$, has been demonstrated. In the case of the $Ln^{3+}$ ions, the smaller their ionic radius, the greater their interaction with the $DBP^-$ ions. Very considerable differences are observed between the different members of the series. The existence of the soluble species $Ln(DBP)^+{}_2$, $Ln(DBP)^-{}_4$ and $Ln(DBP)^{2-}{}_5$

has been shown. Iron(III) and chromium(III) form very different complexes. Chromium(III) gives rise mainly to $Cr(DBP)^{-}_{4}$ and the relatively soluble $Cr(DBP)_3$, whereas iron is of very low solubility over the whole range of $DBP^{-}$ ion concentrations which can be obtained in aqueous solutions.

851 **Thermodynamic instability of a solid solution of aluminium in plutonium (delta-phase) at room temperature.** Akhachinskii, V.V.; Timofeeva, L.F. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)). pp 161-169 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980). (In Russian)

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

Using solution calorimetry, the authors determine the standard enthalpies of formation of solid solutions of aluminium plutonium (delta-phase) with compositions Pusub(0.9401) Alsub(0.0599+-0.0001) and Pusub(0.9103) Alsub(0.0897+-0.0001). On the basis of data yielded by this research and of published data, the authors evaluate the variation in the free energy of reaction involving the decomposition of the delta-phase, and draw the conclusion that the delta-phase is thermodynamically unstable at room temperature. The lower stability boundary for the delta-phase is calculated as 383 K (110°C).

852 **Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide.** Zagryazkin, V.N.; Panov, A.S.; Fivejskii, E.V. (AN SSSR, Moscow. Inst. Metallurgii). pp 171-184 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980). (In Russian)

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

The authors consider the thermodynamics of uranium carbide, uranium sulphide and uranium carbosulphide and perform a thermodynamic analysis of their interactions with transition metals. Theoretical calculations and experimental results show that at 1750-1950°C carbosulphide solid solutions based on uranium monosulphide do not carburize tungsten and molybdenum, but do carburize niobium and tantalum, at appreciably lower rates than UC does. Uranium carbosulphide in solid solution with uranium monocarbide carburized all metals.

# 42 ENGINEERING

## 4202 Facilities And Equipment

*REFER ALSO TO CITATION(S) 284, 340, 507, 674, 1659, 1660, 1690, 1691*

853 (INIS-mf—6447, pp vp) **Importance of leak flow mode assumptions for interpretation of package leaktightness tests and influence of test conditions on conclusions.** Kirchner, B.; Blum, P.T. (Transnucleaire, 75 - Paris (France)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

854 (INIS-mf—6447, pp vp) **Leak testing and activity leakage rate evaluation. Practical experiences, first approaches to some systemization and outstanding problems.** Kowalewsky, H. (Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

855 (INIS-mf—6447, pp vp) **Assessment of the containment of the UK 250 litre plutonium nitrate package.** Butterfield, R.S. (UKAEA, Risley). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

856 (INIS-mf—6447, pp vp) **Comparison of potentional crush and impact environments.** Colton, J.D.; Romander, C.M. (SRI International, Menlo Park, CA (USA)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

857 (INIS-mf—6447, pp vp) **Need for emergency preparedness in transport of radioactive materials.** Bernardo, B.C. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Safety and Environmental Protection). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

858 (INIS-mf—6447, pp vp) **Evaluating dangerous goods emergency response with time/loss analyses.** Driver, E.T.; Benner, L. Jr. (National Transportation Safety Board, Washington, DC (USA)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

859 (INIS-mf—6447, pp vp) **Rescue container to accommodate defective transport containers filled with uranium hexafluoride.** Beyen, H. (Braunkohle G.m.b.H., Wesseling (Germany, F.R.). Reederei und Spedition). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

860 (INIS-mf—6447, pp vp) **Investigation of gas leakage from sealing constructions at containments for radioactive materials.** Heumos, K.; Kowalewsky, H.; Weise, H.P. (Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

861 **Experience with a servo-hydraulic mechanical testing machine installed in a new shielded active facility at Windscale Nuclear Power Development Laboratories.** Garlick, A.; Hindmarch, P.; Gravenor, J.G.; Rhodes, D. (UKAEA Windscale Nuclear Power Development Labs.). pp 241-247 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

An Instron model 1273 servo-hydraulic machine has been installed within a lead-shielded cell at Windscale in order to provide a facility capable of performing a wide range of mechanical tests on nuclear reactor structural materials and fuel assembly components. This particular type of machine was chosen because it has design features associated with the load frame, location of the actuator and adjustment and clamping of the cross-head that are especially well suited to remote operation within a shielded cell. In this paper the design of the testing facility is described and the programmes of work that have been completed over the past 1 1/2 years of operation are reviewed.

862 **Portable $10^4$ curie shielded cell.** Buergisser, B.; Sprunger, E. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). pp 249-254 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The basic construction of a completely portable shielded hot cell for housing a wide variety of measuring and testing equipment is described. The cell can be mounted on the rear wall of any one

of five existing cells providing a very rapid extension of the cell operating potential.

863 **Renovations of beta-gamma hot cells for materials studies at CRNL.** Mizzan, E.; Chenier, R.J.; Hunton, A.E.; Kelm, J.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). pp 255-259 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Over the past decade, the beta-gamma Hot Cell Facility for examination of experimental fuels at the Chalk River Nuclear Laboratories (CRNL) has been undergoing continual renovations in order to meet operating efficiency and personnel safety requirements. Considerable progress has been made by up-grading the metallographic capabilities, improving the drainage and air filtering systems, and adopting removable modular-type in-cell working surfaces. This progress is continuing with progressive cell renovations.

864 **Refurbishing of the hot cell Celimene for the post-irradiation examination of PWR assemblies.** Lhermenier, A.; van Craeynest, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). pp 261-265 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The hot cell 'CELIMENE', contiguous to the EL 3 experimental reactor initially used to dismantle the experimental irradiation devices, has been converted to receive, handle and examine irradiated fuel assemblies coming from power reactors. It is now possible to follow the behaviour of fuel assemblies during the irradiation or reprocessing cycle, to extract a representative assembly from the normal fuel cycle, to work out on this assembly non destructive examinations, to extract some fuel rods and to reincorporate this assembly with a new head in the normal cycle, in order to handle it, in reprocessing facility or in a storage pool. By using adequate remounting techniques, it is possible to reirradiate the assembly after examination. Some important changes have been made to buildings and on handling cranes to permit the handling of big and heavy fuel containers. A refurbishing of handling systems, machining apparatus, and storage devices, in the hot cell was also necessary. Using a special bench construction, some non destructive tests, optical examinations and metrology will be possible on fuel assemblies before dismantling, or on their structure, after dismantling.

865 **Refurbishing of a cave line at Berkeley Nuclear Laboratories.** Haddrell, V.J.; Stagg, M.S. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 267-271 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

A line of three caves were stripped and then refurbished. The approach to the refurbishing is discussed and the details of this equipment are given. The subsequent installation of the free-standing equipment and the working experience gained using these facilities are also included.

866 **PFR reprocessing plant cave.** Barrett, T.R.; Dodd, T.; Thom, D. (UKAEA Dounreay Nuclear Power Development Establishment); Reekie, J. (British Nuclear Fuels Ltd., Risley). pp 273-278 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The DFR reprocessing plant at the Dounreay Nuclear Power Development Establishment, UKAEA, had included two cave facilities and it was decided, as part of a plant reconstruction exercise, to demolish one of these - the DFR blanket (breeder) element cave - and build a new cave on that site. This was done as part of a major decommissioning and reconstruction exercise. The major part of the plant chemical process solvent extraction system was completed in the summer of 1979 and resumed active operations reprocessing the final DFR irradiated fuel from September 1979. The new PFR fuel dissassembly cave was structurally completed in 1978 and has progressively been fitted out with its equipment - some of which had been previously assembled and tested out cave - and is presently being commissioned as an entity. The facilities are described.

867 **Advanced manipulator system for large hot cells.** Vertut, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Moreau, C. (Societe A.C.B., Nantes (France)); Brossard, J.P. (Ste La Calhene). pp 287-293 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Large hot cells can be approached as extrapolated from smaller ones as wide, higher or longer in size with the same concept of using mechanical master slave manipulators and high density windows. This concept leads to a large number of working places and corresponding equipments, with a number of penetrations through the biological protection. When the large cell does not need a permanent operation of number of work places, as in particular to serve PIE machines and maintain the facility, use of servo manipulators with a large supporting unit and extensive use of television appears optimal. The advance on MA 23 and supports will be described including the extra facilities related to manipulators introduction and maintenance. The possibility to combine a powered manipulator and MA 23 (single or pair) on the same boom crane system will be described. An advance control system to bring the minimal dead time to control support movement, associated to the master slave arm operation is under development. The general television system includes over view cameras, associated with the limited number of windows, and manipulators camera. A special new system will be described which brings an automatic control of manipulator cameras and saves operator load and dead time. Full scale tests with MA 23 and support will be discussed.

868 **Modern design for $\alpha$ $\beta$ $\gamma$ active handling facilities for chemical research and development.** Brown, P.E.; Findlay, J.R. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.); Campbell, D.; Ritchie, A.B.; Steele, J.J. (UKAEA Atomic Energy Research Establishment, Harwell. Engineering Div.); Fudge, A.J.; Kitt, G.P.; Jackson, N. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). pp 295-300 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

A design study for a modern $\alpha\beta\gamma$ active handling facility for chemical research and development work is described. The design is intended to achieve the working and environmental conditions that are expected to be acceptable in the nuclear industry at least for the next twenty years. Radiation exposure to operators is reduced to minimum practical limits. Hands-on maintenance and man-entry are avoided for routine operations. The design is flexible to allow modifications and improvements of technique and concept to be incorporated as they become available. Finally decommissioning can be achieved with reversion to a contamination and radiation free site. The primary installation in the design is a suite of five in-line $\alpha\beta\gamma$ active shielded cells, each capable of handling 1000 MeV Ci $\gamma$ activity with accompanying high levels of $\alpha$ and or $\beta$ activity. Each cell is fitted with a stainless steel containment box which is remotely removable. Adjacent to the cell line, there is a box handling bay to which boxes are interfaced, serviced and decontaminated. These operations are entirely remote. The box, when decontaminated, is returned through a commissioning area to the cell line for further service. Comprehensive facilities are provided to support the cell line. These include flask and equipment storage, fissile material accounting and interrogation systems, waste handling and

transfer systems for the onward transmission of waste for processing and packaging centrally. The problems of manipulation, transfers, contamination control and shielding have been considered and are discussed in the context of the overall design.

869 **Advanced design concepts for post-irradiation examination facilities.** Hale, C.W.; Richardson, E.K.; Vaughan, G.A. (UKAEA Windscale Nuclear Power Development Labs.). pp 301-306 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

This paper first considers the standards of radiological protection required over the next two or three decades. The effect of these standards upon the future design targets for shielding, containment, operation and maintenance is then discussed. Finally, after looking at some of the problems with present-day PIE facilities, the paper indicates some possible future developments that could meet the set design targets satisfactorily.

870 **Remote handling and viewing for the future.** Peagram, G.W.; White, L.J.; Bauer, G.J. (UKAEA Atomic Energy Research Establishment, Harwell. Engineering Div.). pp 313-318 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

As one of the main UK centres for research and development of remote handling and viewing, Harwell in particular, the Project Engineering Group, is engaged on an extensive programme of developing new equipment which will permit the introduction of new concepts of active handling facility design. The paper will set out the reasons for a new approach ie increasing activity levels due to high burn up fuel which will have to be dealt with under increasingly stringent safety conditions. It will then outline the range of the programme which includes development of new master slave manipulator systems, servo manipulators, viewing systems both direct and indirect, (ie CCTV) filter test, change and disposal systems. The main body of the paper will contain one or more detailed presentations recording the latest information on specific development areas.

871 **Some improvements in handling techniques into commercial nuclear reactors.** Biver, E. (Gradel S.A., Luxembourg); Removille, J. (Euratom, Bruxelles (Belgium)). pp 330 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

872 **System for PIE of irradiated fuel pins, employing minimal active volume and remotely controlled transport system.** Moody, B.R.; Lowe, D.B.; Lowe, D.W. (Taylor Hitec Ltd). pp 339 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

873 **Recent improvements in facilities for gamma-scanning and other non-destructive examinations of irradiated materials at ECN's hot cell plant L.S.O.** Dassel, G.; Wervers, H.J. (Stichting Energieonderzoek Centrum Nederland, Petten). pp 97-102 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The ECN Materials Department - Hot Cell Plant LSO utilises gamma-scanning to investigate irradiated fuels and cladding hulls of irradiation capsules with respect to fission-product distribution and integrated neutron flux respectively. As the hot cell plant became more engaged in programmes involving longer items (fuel pins and control rods) from different origin in addition to the normal supply of objects to be examined, more satisfactory equipment had to be realised. Consequently two identical gamma-scanning machines having an axial travel range of 2000 mm were recently installed; a very similar machine equipped with an eddy-current probe and a diameter sensor, has additionally been installed; the latter unit is also used as a displacement device for visual inspection by means of a T.V.-camera. The expansion in the number of spectrometric measuring stations has led to a thorough review of the requirements of the associated electronic equipment. A study of available options made by the ECN Electronics Group resulted in the purchase of an on-line computer which can handle the data acquisition, data analysis and machine motion-control for up to four independent stations simultaneously.

874 **Computer based recording and handling of non-destructive PIE data at Risoe.** Bagger, C. (Risoe National Lab., Roskilde (Denmark)). pp 109-114 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

A computer based data acquisition and handling system for gamma and dimensional measurements has been in service since 1976. The system which at present is being extended to other post irradiation examination fields such as eddy current testing has increased the amount of raw data acquired considerably, but quick and efficient methods of storage and filtering of data has decreased the time necessary for evaluation of experiments. The general reliability of the measurements has been increased by introducing routine quality control procedures in the data sampling programmes. Further improvement of reliability has been obtained by use of precise positioning devices allowing repetition of measurement series with intermittent recalibration of measuring equipment. The computer based acquisition of gamma- and dimensional measurements together with the subsequent handling of resulting data is described.

875 **Evolution of the equipment and recent developments in the alpha, beta, gamma-laboratory of the European Institute for Transuranium Elements.** Coquerelle, M.; Whitlow, W.H. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). pp 155-160 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The $\alpha$, $\beta$, $\gamma$-laboratory of the European Institute for Transuranium Elements has been in operation since 1966. The principal items of the equipment include instruments for non-destructive examinations and laboratories for optical microscopy and radiochemistry. From 1973, new tasks arising from the evolution of the research programmes were given to the laboratory, including the compatibility between stainless steel and mixed oxide fuels, the swelling of advanced fuels and the controlled oxidation of advanced fuels. A number of advanced metallographic techniques were employed. In the frame of the corrosion studies, metallographic techniques such as interference and magnetic etching were developed together with electron probe microanalysis and electron microscopy. In the study of the swelling of advanced fuels, quantitative microscopy was used. Porosity was measured by means of an image analyzer, operating on-line on the microscope and the quantitative information was obtained by using a calculation code.

876 **Combustion engineering comprehensive fuel inspection stand.** Corsetti, L.V.; Hutchinson, J.J. (Combustion Engineering, Inc., New York (USA)). pp 173-189 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

In 1977 Combustion Engineering developed a Comprehensive Fuel Inspection Stand (CFIS) to provide capabilities adaptable to a wide range of inspection activities. The CFIS is a completely self contained portable structure designed for use at various reactor spent fuel pools. It permits remote inspection of fuel assemblies, individual rods, or other components to be performed without impacting critical path refueling operations. Specific inspection capabilities are obtained with special equipment modules that can be remotely installed or removed from the CFIS as required. Basic details of the design and operation of the CFIS are discussed. Typical results are presented to illustrate inspection capabilities.

877 **Framatome's multiple examination device and on-site removable fuel rods examination stand.** Zecevic, V.; Bellaiche, H.; Delevallee, A.; Bauchede, J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME) - Lyon (France)). pp 187-192 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

After recalling the basic necessity which exists in order to understand, correct and improve the behaviour of the fuel assembly in operation in a nuclear power plant, the progress accomplished in the post irradiation examination techniques is indicated. Then are described two types of equipment that have been designed to investigate very completely at the end of each cycle most characteristics of irradiated fuel assemblies and individual fuel rods.

878 **Recent developments in post-irradiation examination techniques at Harwell.** Clark, P.A.; Clough, D.J.; Demant, J.T.; Evans, J.H.; Keep, R.H.; Paris, R. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.); Garner, B.E. (UKAEA Atomic Energy Research Establishment, Harwell. Research Reactors). pp 199-206 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Developments in post-irradiation techniques at Harwell since 1972 are described. These include the installation of a shielded optical microscope and image analyser, the use of mercury pyknometer, equipment for changing active corrosion fatigue test pieces, ultrasonic trepanning, automated metrology and the non-destructive measurement of fuel/clad gaps.

879 **Method of study applied to safety of post-irradiation facilities.** Hale, C.W.; Jepson, M.D.; Turier, C.A. (UKAEA Atomic Energy Establishment, Winfrith). pp 219-224 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The two major facilities for the PIE of Thermal Reactor fuels are situated at Winfrith Atomic Energy Establishment where a wide variety of fuel elements are examined and dismantled in suites of manipulator operated caves and at the Windscale Nuclear Power Development Laboratory where routine destructive examination of fuel pins and other components is carried out in lines of tong operated lead shielded cells. During the past ten years both these sites have conducted independent studies of how, and from where personal radiation exposures occur. The facilities at each site are significantly different as in the type of work, and hence the problems also have some differences. At Winfrith crud deposits and the sheer volume of radioactive materials significantly affects the man-rem doses, whereas at Windscale the cutting/grinding/polishing processes produce fuel dust, and the movement of many small specimens also contribute to man-rem doses. The paper is therefore presented in two distinct sections.

880 **Comprehensive post-irradiation examination of power reactor fuels and core component materials.** Matsumoto, T. (Japan Atomic Energy Research Inst., Tokyo). pp 229-234 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The Reactor Fuel Examination Facility for post-irradiation examination of power reactor fuels has been in operation since December 1979 at the Tokai Research Establishment of the Japan Atomic Energy Research Institute. The facility features six beta-gamma cells, two alpha-gamma cells, five lead cells, and the latest equipment available for performing post irradiation examinations on a wide variety of reactor fuels. Two BWR fuel assemblies are now under examination and data have been accumulated as a consequence of ongoing research on important topics of power reactor fuel and cladding materials.

881 **Fuel element and materials hot laboratory in Beijing.** Wang, S.R.; Chen, C.K. (Fuel Element and Materials Lab., Institute of Atomic Energy, Academia Sinica). pp 279-281 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The Hot Laboratory contains ten cells, of which the main contents of work are sample storing, non-destructive inspection, dimensional measurements, X-radiograph, burnup determination, cutting, tensile testing, specimen preparation for optical microscopy, metallography and the like. Tests for creep and fatigue on irradiated structure materials are also conducted in two 'semi-hot' cells.

882 **Optical devices for remote examination.** Haddrell, V.J.; Paisey, M.S. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Smallcalder, R. (UKAEA Atomic Energy Establishment, Winfrith). pp 337 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

883 **Hot cell installation for biaxial creep and burst testing of cladding specimens.** Van de Velde, J.; Mast, J.; Demildt, A.C. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). pp 343-344 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The L.H.M.A. hot laboratory provides a range of facilities for the mechanical testing of cladding material from irradiated fuel pins. This paper gives a brief description of the apparatus for biaxial creep and burst testing that has been developed in the laboratory. This equipment is installed in a relatively small $\alpha$-$\beta$-$\gamma$ lead-shielded hot cell. Techniques for specimen preparation and conditioning as well as the test procedures are indicated.

884 **Remotely operated scanning electron microscope for the examination of irradiated materials.** Haddrell, V.J.; Rickards, G.K.; Paisey, M.S. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp 350 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

**885 Some in cell machines developed for destructive PIE.** Bowen, J.; Jepson, M.D. (UKAEA Windscale Nuclear Power Development Labs.). pp 351-352 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

During the past two decades a large number of machines have been designed, developed, built and used in the facilities for destructive PIE at Windscale Nuclear Power Development Laboratories. Many of them were developed for one-off operations but some were for continuing functions which are common to all metallographic work; a selection of these are described and illustrated viz. compact uranium cutting machine, $UO_2$ cutting machines, can slitting machine, grinding and polishing machine, waste compactor, and small pneumatically operated vacuum cleaner.

**886 Laser cutting equipment for dismantling irradiated PFR fuel sub-assemblies.** Higginson, P.R.; Campbell, D.A. (UKAEA Dounreay Nuclear Power Development Establishment). pp 135-141 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

Laser cutting was identified as a possible technique for dismantling irradiated Prototype Fast Reactor (P.F.R.) fuel sub-assemblies and initial trials showed that it could be used to make essentially swarf free cuts in P.F.R. wrapper material provided sufficient laser power was available to allow use of an inert cutting gas. A programme of development work has established a technique for inert gas cutting with the reliable, commercially available Ferranti MF 400 laser and equipment for laser cutting of sub-assemblies has been installed in the Irradiated Fuel Cave at P.F.R. Test cuts carried out with this equipment on un-irradiated wrapper sections have shown it to be easy to operate remotely, optically stable and reliable in operation.

**887 Postirradiation handling and examination at the HFEF complex.** Bacca, J.P. (Dow Chemical Co. (USA)). pp 193-198 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

The Hot Fuel Examination Facility provides postirradiation handling and examination of fast reactor irradiation experiments and safety tests for the United States Breeder Reactor Program. Non-destructive interim examinations and destructive terminal examinations at HFEF derive data from tests irradiated in the Experimental Breeder Reactor No. II, in the Transient Reactor Test Facility (TREAT), and in the Sodium Loop Safety Facility. Similar support will be provided in the near future for tests irradiated in the Fast Flux Test Facility, and for the larger sodium loops to be irradiated in TREAT.

**888 In cell machines for the inspection of fast reactor fuel elements.** Pietz, M.R. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)); Riedel, M.R. (Babcock Wilcox, Oberhausen); Biver, E. (Gradel S.A., Luxembourg); Removille, J. (Euratom, Bruxelles (Belgium)). pp 329 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).



*REFER ALSO TO CITATION(S) 1676*

**889 Investigation of a high power tunable dye laser.** Hirth, A.; Vollrath, K.; Gulitz, G. (Deutsch-Franzoesisches Forschungsinstitut Saint-Louis, Saint-Louis/France). pp 226-229 of Proceedings of the 13th international congress on high speed photography and photonics. Hyodo, S. (ed.) (Tokyo Univ. (Japan). Faculty of Engineering). Tokyo, Japan; Japan Society of Precision Engineering (1979).

From 13. congress on high-speed photography and photonics; Tokyo, Japan (20 Aug 1978).

A tunable organic dye laser pumped by a large coaxial flashlamp is described. The influence of the parameters of the electrical driving circuit and of the dye solution on the lasers output energy is investigated. With a rhodamine 6G solution in methanol, pumped by 10 kJ electrical energy, laser pulses of 2.5 μs duration are obtained. Conversion efficiency attains 0.46%.

**890 Theoretical and experimental investigations of the electrical excitation rates in TEA-$CO_2$-lasers.** Donnerhacke, K.H. (VEB Carl Zeiss, Jena (German Democratic Republic)); Schubert, M.; Wiederhold, G. (Friedrich-Schiller-Universitaet, Jena (German Democratic Republic). Sektion Physik). pp 629-630 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

**891 Investigation of some processes in the hydrogen laser plasma.** Ross, W. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik); Florek, S.; Gatzke, J. (Akademie der Wissenschaften der DDR, Berlin). pp 633-634 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

**892 Connection of the copper vapour laser emission pulse characteristics with plasma parameters.** Klimovski, I.I.; Vokhmin, P.A. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). pp 635-636 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

**893 Electron energy distribution function for copper vapour.** Rodin, A.V.; Zemtsov, Yu.K. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). pp 637-638 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

**894 Experimental investigation of the pulse discharge in Cu + Ne mixture in high repetition rate regime.** Elaev, V.F.; Kirilov, A.E.; Polunin, Yu.P.; Soldatov, A.N.; Fedorov, V.F. (Scientific Instrument Manufacture 'Optika', Tomsk (USSR)). pp 639-640 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

895 **Peculiarities of electric discharges in mixtures of metal vapors and rare gases at increased pressures.** Bokhan, P.A.; Klimkin, V.M.; Prokopiev, V.E. (AN SSSR, Tomsk. Inst. Optiki Atmosfery). pp 641-642 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

896 **Inversion of excited atom states in cesium and nitrogen-cesium plasma.** Antonov, E.E.; Korchevoy, Yu.P.; Lukashenko, V.I. (AN Ukrainskoj SSR, Kiev. Inst. Ehlektrodinamiki). pp 643-644 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

897 **Inversion of the atomic level population densities in low temperature alkali plasma.** Filippov, S.S. (AN SSSR, Moscow. Inst. Prikladnoj Matematiki). pp 645-646 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

898 **Emission properties of nitrogen laser discharges.** Guendel, H.; Irmer, J. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 647-648 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

899 **Collisional radiative model for the argon ion system.** van der Sijde, B.; Pots, B.F.M. (Technische Hogeschool Eindhoven (Netherlands)). pp 649-650 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

900 **Energy balance of noble gas ion laser discharges.** Ebert, W. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 651-652 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

901 **Ion acoustic waves in noble gas ion lasers.** Redlich, L. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 653-654 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

## 4204 Heat Transfer And Fluid Flow

*REFER ALSO TO CITATION(S) 282, 439, 558*

902 **Power series solutions of the thermal-hydraulic conservation equations.** Agee, L.J. (Electric Power Research Inst., Palo Alto, CA (USA)). pp 385-410 of Transient two-phase flow. Proceedings of the second CSNI specialists meeting, Paris, 12-14 June 1978. Vol. 1. Reocreux, M.; Katz, G. (eds.). Paris, France; Commissariat a l'Energie Atomique (Feb 1981).

From Meeting on transient two-phase flow; Paris, France (12 Jun 1978).

The solution technique presented in this paper is an extension of a method used by Agee (AGEE, 1971) to solve the homogeneous thermal-hydraulic conservation equations used by the FLASH (REDFIELD, 1969) and RELAP (MOORE, 1973) programs. The extension of the method to the more general separated flow case requires the following semi-independent steps: 1) reduce the quasi-linear partial differential equations to a set of K ordinary differentials by use of any general difference formula; 2) form the coefficient series from the known series representation of the dependent variables by algebraic manipulation (i.e., addition, subtraction, multiplication, division, logarithm, and exponential operations) of N-th order power series; 3) solve the resulting set of nonlinear ordinary differential equations by power series methods which are exact to order N; 4) obtain the solution to the coupled set over a 'long' time zone by applying a modified Cauchy-Picard iteration technique; or use the solution obtained in Step 3 over time steps for which the first order coupling is significantly accurate; 5) extend the solution to arbitrary times by utilizing analytical continuation of the existing power series for the dependent variables.

903 **Comparison of some implicit finite difference schemes used in flow boiling analysis.** Latrobe, A. pp 439-455 of Transient two-phase flow. Proceedings of the second CSNI specialists meeting, Paris, 12-14 June 1978. Vol. 1. Reocreux, M.; Katz, G. (eds.). Paris, France; Commissariat a l'Energie Atomique (Feb 1981).

From Meeting on transient two-phase flow; Paris, France (12 Jun 1978).

This study has been limited to low order schemes which are already used in some system codes. We have tested them on the simplest two-phase flow model, i.e. the three equations homogeneous model. The main objective of the paper is to prove that the need for further comparisons is doubtless. We review briefly the difficulties which must be overcome for the comparisons to be valid. First of all, the discretization of the three conservation equations yields to non linear dicrete systems. The types of linearization used in codes such as RAMA, K. FIX and CLYSTERE are not equivalent at all and this might have a non-negligible infuence on the results and on the computer-time used to solve a particular problem. Secondly, for implicit schemes, the method to solve the linearized system should be the same, for instance Gaussian elimination with pivoting. Thirdly, special treatments for dealing with discontinuities such as the Boiling Boundary, the breech, if any, must be the same. If has been proven that some schemes can handle discontinuities much better than other and that's also an important point of comparison. These restrictions have convinced ourselves that a good comparison should be made with a unique code, specially designed to be very flexible with respect to the Finite Difference Scheme used.

904 **Turbulence in two-phase flows.** Sullivan, J.P.; Houze, R.N.; Buenger, D.E.; Theofanous, T.G. (Purdue Univ., Lafayette, IN (USA)). pp 583-612 of Transient two-phase flow. Proceedings of the second CSNI specialists meeting, Paris, 12-14 June 1978. Vol. 2. Reocreux, M.; Katz, G. (eds.). Paris, France; Commissariat a l'Energie Atomique (Feb 1981).

From Meeting on transient two-phase flow; Paris, France (12 Jun 1978).

Hot film Anemometry and Laser Doppler Velocimetry have been employed in this work to study the turbulence characteristics of Bubbly and Stratified two-phase flows, respectively. Extensive consistency checks were made to establish the reliability and hence

the utility of these experimental techniques for the measurement of turbulence in two-phase flows. Buoyancy-driven turbulence in vertical bubbly flows has been identified experimentally and correlated in terms of a shear velocity superposition approach. This approach provides a criterion for the demarcation of the buoyancy-driven turbulence region from the wall shear-generated turbulence region. Our data confirm the roughly isotropic behavior expected for buoyancy-driven turbulence. Upgrading of our experimental system will permit investigations of the wall-shear dominated regime (i.e., isotropy, superposition approach, etc.). The stratified flow data demonstrate clearly that the maximum in the mean velocity profile does not coincide with the zero shear plane, indicating the existence of a negative eddy viscosity region. Previous studies do not take into account this difference and thus they yield incorrect friction factor data in addition to certain puzzling behavior in the upper wall region. The conditioned turbulence data in the wavy region indicate interesting trends and that an appropriate normalization of intensities must take into account the shear velocity at the interfacial (wavy) region.

### 4210 Combustion Systems

905 **(CONF-8004173—11) Operating experience with a fluidized bed steam generator at Georgetown University.** Lutes, I.G.; Gamble, R.L.;. (Foster Wheeler Boiler Corp., Livingston, NJ (USA)). 1980. 17p. Univ. of Kentucky, 112 Frazee Hall, Lexington. Order Number DE82900069.

From 19. annual Kentucky industrial coal conference; Lexington, KY, USA (30 Apr 1980).

Operation of the 100,000 lb/h capacity, coal-fired fluidized bed steam generator at Georgetown University began in July 1979. This project, which was cofunded by Georgetown University and the US Department of Energy, involved expansion of the heating and cooling plant with this new coal fired facility. Previously existing units at the University heating and cooling plant normally fire natural gas. The fluidized bed steam generating facility at Georgetown University is the only new coal fired facility to be built in the Washington DC area in many years. The purpose of this program is to demonstrate industrial and institutional application of fluidized bed combustion using high sulfur coal in an environmentally acceptable manner in a populated area. The unit has been successfully operated for over 1400 h and in compliance with the strict emission regulations of Washington DC. Operation on automatic control has been achieved and only minor operating difficulties have been experienced. The design, operation and performance of the plant are discussed.

### 4240 Pollution Control Equipment

*REFER ALSO TO CITATION(S) 845, 984, 1000*

## 43 PARTICLE ACCELERATORS

### 4301 Design, Development, And Operation

906 **400 kV proton beam facility for the study of silicon semiconductor detector surfaces and of the stopping power of biological materials.** Haque, A.K.M.M.; Hasko, D.G.; Nikjoo, H.; Hossain, D.; Mohammadi, A. (Polytechnic of the South Bank, London (UK)). pp 48-53 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A proton beam stable at energies up to 400 keV from a van de Graaff accelerator has been obtained by attenuation due to backscattering from a gold layer on a beryllium substrate and collimation, to provide a beam of intensity approximately equal to 3 x $10^3$ p/s for use with a surface barrier detector. This is being used to measure window thicknesses of surface barrier detectors and the stopping power of polythene films. The results of window thickness measurements are compared with the model due to Hansen (Nucl. Instrum. Meth.; 96:373 (1971)) showing reasonable agreement. Polythene films of various thicknesses have been fabricated by withdrawing optically flat glass plates from a molten solution. Thickness and uniformity of the films are investigated using interferometry. Energy loss measurements are obtained and the straggling compared with Bohr theory.

907 **Contribution to neutron dosimetry at the synchrocyclotron at the Joint Institute for Nuclear Research, Dubna.** Fulop, M. (Vyskumny Ustav Hygieny Prace a Chorob z Povolania, Bratislava (Czechoslovakia)); Turek, K. (Ceskoslovenska Akademie Ved, Prague. Ustav Radiologicke Dozimetrie); Somogyi, G. (Magyar Tudomanyos Akademia Atommag Kutato Intezete, Debrecen). pp 263-275 of Advances in radiation protection monitoring. Proceedings of an international symposium held by the IAEA in Stockholm, Sweden, 26-30 June 1978. Vienna, Austria; IAEA (1979).

Multidetector spectrometry has been used to determine the neutron-energy spectrum-to-dose equivalent conversion factor as well as to establish the neutron dosimetry conditions with the aim of suggesting a system for making routine surveys at the Joint Institute for Nuclear Research's synchrocyclotron at Dubna. As multidetector spectrometer, the Bonner's multisphere system supplemented by fission detectors (U, $^{232}$Th and $^{209}$Bi) was used. Hard and soft neutron energy spectra at two locations were measured. The dependence of the dose equivalent on depth in a body has been determined for unilateral and for bilateral irradiation with broad beams of normally incident neutrons. Bilateral irradiation has been found to be the closest approximation to the real irradiation conditions. It has been shown that the surface dose equivalent at the synchrocyclotron is practically identical with the maximum of the depth distribution of the dose equivalent in a body. The contribution of dose equivalent of neutrons with energies under 1 MeV to the total surface dose equivalent is less than 20%. A system of solid-state nuclear track detectors, Melinex O with a $^{209}$Bi radiator and Makrofol E, has been proposed for routine surveys of neutron fields. For this purpose an estimate was made of the variation of detection efficiency of Makrofol E with energy up to relativistic neutron energies. To increase the sensitivityand to improve the visual counting of the track damage detectors, a method of electrochemical etching has been verified.

### 4302 Beam Dynamics, Field Calculations, And Ion Optics

908 (IA—1356, pp 293-294) **Universal characteristics of a wedge-type beam for high current electromagnetic isotope separators.** Chavet, I.; Kanter, M.; Menat, M.; Lempert, G.D. Apr 1980. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1978 and 1979.

909 (INIS-mf—6295, pp 162-166) **Super high-energy intense neutrino beam shaping.** Garkusha, V.I.; Kartashev, V.P.; Kotov, V.I.; Rzaev, R.A.; Rykov, V.L.; Sakharov, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1979. (In Russian). Dep. NTIS (US Sales Only).

From 6. conference on particle accelerator; Dubna, USSR (11 Oct 1978).

Results of calculating a focusing system for a neutrino channel are presented. The system consists of two lithium lenses and a symmetrical triplet of quadrupole lenses. Optimization calculations showed that parameters of lithium lenses No.1 and No.2 should constitute, respectively, the length 20 and 18 cm, the radius 1.4 and 2.8 cm and the current 500 and 630 kA. The triplet of quadrupole lenses consists of lenses with gradients of 1300 Oe/cm, a length of 2 m (the outer ones) and 4 m (the central one), and an aperture of 20 cm. Angular envelopes of particle beams at the output of the combined system and system comprising axially symmetrical elements are given. A marked effect in the envelope behaviour is observed in the region of great particle momenta. In using both the combined and the axially symmetrical systems the neutrino and antineutrino spectra coincide throughout the momentum range with increasing the neutrino and antineutrino flux 3 times and more. The integrated

flux of background particles when the combined system is used is 1.6 times higher.

910 **Beam transport for ion implantation.** Bannenberg, J.G. (FOM-Instituut voor Atoom-en Molecuulfysica, Amsterdam (Netherlands)). pp 1-12 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

The general laws in ion optics like Snell's law, the Helmholtz-Lagrange law and Liouville's theorem and their consequences in beam transport are given. The concept of imaging and waist-to-waist transport using the matrix representation is discussed. The various types of ion optical elements like electrostatic cylindrical and quadrupole lenses, accelerating tubes, and analysing magnets are briefly described. The combination of these elements in ion implantation equipment is discussed.

911 **Low-energy ion beam transport by permanent magnets.** Leung, K.N.; Ehlers, K.W.; Hooper, E.B. (UKAEA Culham Lab., Abingdon). pp 20-25 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

An experimental investigation of beam guiding by permanent magnets in a cusp arrangement has been performed. A 325 eV, divergent, positive hydrogen ion beam was extracted from an ion source into a long, stainless steel pipe and the current on the beam collector measured as a function of distance from the extractor. From a study of the effect on the beam current of mounting samarium cobalt magnets in different geometries on the external surface of the pipe, it was found that magnets arranged in a multi-ring-cusp configuration produced the best beam transport efficiency.

912 **Electrostatic scanning of a few mA ion beam. Application to an ion implanter.** Camplan, J.; Chaumont, J.; Meunier, R. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). pp 95-99 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

The use of a dog-leg electrostatic condenser for the rapid scanning (1000 Hz) of a few mA beam of an ion implanter is described. Such a condenser, in association with a doublet of magnetic quadrupoles to give line focus, is used in an ion implanter named SCANIBAL which operates with hybrid scanning. The performance and lay-out of this ion-implanter are discussed.

## 4303 Auxiliaries And Components

*REFER ALSO TO CITATION(S) 450*

913 (KURRI-TR—190, pp 10-13) **Study of nuclear reactions in high energy using solid state track detectors.** Hayashi, S.; Iwata, S. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1979. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on solid state track detection of radiations; Kumatori, Osaka, Japan (29 May 1978).

914 **UNIBUS processor interface for a FASTBUS data acquisition system.** Larwill, M.; Lagerlund, T.D.; Barsotti, E.; Taff, L.M.; Franzen, J. (Fermi Lab., Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 385-389(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

Current work on a FASTBUS data acquisition system at Fermilab is described. The system will consist of three pieces of FASTBUS hardware: a UNIBUS processor interface (UPI), a dual-ported bulk memory, and a FASTBUS "event builder" (i.e., data acquisition processor). Primary efforts have been on specifying and constructing a UPI. The present specification includes capability for all basic FASTBUS operations, including list processing of consecutive FASTBUS operations. Some possible FASTBUS data acquisition system architectures employing the UPI are discussed along with some detailed specifications of the UPI itself.

915 **Selection case history, minicomputer network control of a large nuclear particle accelerator. Chapter 7.6.** Crowley-Milling, M.C. (European Organization for Nuclear Research, Geneva (Switzerland)). pp 455-476 of Minicomputers. A reference book for engineers, scientists and managers. Paker, Y. (Polytechnic of Central London (UK)). Tunbridge Wells, England; Abacus Press (1981).

CERN are now in the process of building a large accelerator (the SPS) with an orbit diameter of 2.2 km, in a tunnel about 40 m underground. Power supplies, etc., for the equipment in the tunnel are situated in six buildings, equally spaced round the ring, 1.1 km apart. All the equipment must be controlled and surveyed from a main control room near one of these buildings, and, to make this possible, computers must be used in the equipment buildings to do some concentration and preprocessing of information and perform some semi-autonomous control functions. The original idea was to use a medium-sized computer in each building, communicating with a central computer, also in the medium size range. Further thought led to the division of functions as far as possible. Where a single major function could be separated in a building, a separate small computer would be used to control that function, and a further small computer in each building would be used to deal with the remaining functions. The procedure for inviting tenders for the computers, and for selecting from the replies, is discussed in detail.

916 **Advances and limitations of commercial ion-implantation equipment.** Glawischnig, H. (Siemens A.G., Muenchen (Germany, F.R.). Unternehmensbereich Bauelemente). pp 60-65 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

Since the principal requirements for the ideal production implanter cannot be met by one type of machine both medium- and high-current implanters have been built. The limitations of present commercial medium-current equipment are shown to be cycling and scan times. For high-current implanters, temperature calculations for pulsed heating show that the available beam current is the principal limiting factor, and not thermal considerations. The same should be true for future equipment with beam currents over 10 mA.

917 **Beam detection and dose measurement.** Hemment, P.L.F. (Surrey Univ., Guildford (UK). Dept. of Electronic and Electrical Engineering). pp 77-90 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

The various beam detection and dose measurement techniques which are applicable to low-energy particle accelerators are

reviewed. A physical model of the ion beam is described. Two classes of beam detectors are considered, namely devices which interrupt the beam and non-contacting devices, which employ induction methods. Quantitative dose measurement techniques are considered, including both target chamber and post-implantation methods. Reference is made to an international standards exercise. 72 references.

**918 Spark-resistant design for high-voltage high-current accelerating columns.** Hepburn, J.D.; Shubaly, M.R.; Ungrin, J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). pp 158-162 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

Design criteria for high-voltage, high-current accelerating columns have been investigated and typical failure modes, related to electrodes, ceramics and ceramic-metal joints, identified. A spark-resistant neutral beam injector accelerator column design, typical of those required for the next generation of tokamaks is used to illustrate the design criteria formulated, showing that these lead to a compact and relatively simple structure.

**919 Dose rates during experiments with heavy ions.** Festag, J.G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). pp 743-746 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The equivalent dose rates originating from reactions with heavy ions ($A>=40$) are not well known. Results from experiments using accelerated ions (5 to 10 MeV/ nucleon) are reported for thick targets. The neutron equivalent rates are measured using rem-counters and the rates due to $\gamma$-rays by ionization chambers or geiger counters with energy filters. In nearly all cases the portion of the equivalent dose rate due to $\gamma$ rays is less than 10% (and often less than 1%) of that due to neutrons. Using activation techniques, it is established that more than 90% of the neutrons have energies less than 11 MeV. Angular distributions of the equivalent dose rates due to neutrons are presented. Finally, possible sources of errors in the measurements are discussed.

**920 200kV heavy-ion accelerator for radiation damage research and its use for studies of radiation-enhanced diffusion and segregation.** Marwick, A.D.; Piller, R.C.; Hobbs, J.E. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). pp 42-47 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

An irradiation damage facility based on a 200 kV Danfysik heavy-ion accelerator is described. The design of the accelerator, is beam lines, and the associated instrumentation are such that radiation damage experiments may be carried out with metal ion beams under known conditions of dose rate, dose and environment. Control and measurement of beam parameters for studies of radiation-enhanced diffusion are emphasised. Beam shape is particularly important when irradiations with defocused beams are necessary, and a method of performing accurate quantitative measurements of beam profiles is described. Automation of the technique is briefly discussed. Experiments which exploit the ability of the heavy-ion accelerator to produce alloys by ion implantation for subsequent irradiation in situ are described. Diffusion measurements reveal that post-implantation irradiation of alloys greatly modifies solute distributions. The changes occurring can be related to the effects of point defects introduced by the damaging ion beam.

**921 Microprocessor based area monitor system for neutron and gamma radiation.** Wilhelm, R.; Heusser, G. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). pp P.747-750 of Radiation protection. A systematic approach to safety. Oxford; Pergamon Press (1980).

A microprocessor based system is described for monitoring the neutron and $\gamma$ radiation in experimental areas around Tandem Van-de Graaff accelerators. The dose rates vary from nondetectable values up to tens of rem/hour (mainly high energy neutrons). To permit maximum access to the experimental areas, high reliability in radiation monitoring is necessary. A system based on microprocessor controlled monitors for each experimental area and connected to a central minicomputer is claimed to be cheaper and more reliable than previous systems. Details are presented of the new system and on how the safety interlocks on the access doors are incorporated. A visual display and an acoustic warning are given in each area of the various radiation levels.

**922 Beam current measuring.** Moskalev, V.A.; Sergeev, G.I.; Shestakov, V.G. pp 6-64 of Izmerenie parametrov puchkov zaryazhennykh chastits. Moscow, USSR; Atomizdat (1980). (In Russian)

The operational principles of different measuring instruments of charged particle beam current in accelerators are considered. Depending on the accelerator type the survey of different methods of measuring beam currents differing in the range, accuracy, degree of the effect on the beam and physical principles laid in the basis of the measuring instrument operation is presented. Recommendations on utilization of the concrete type of measuring instruments (electrostatic, magnetoinduction, Hall sensors, transformers based on measuring counter-current flow induced by the beam in ion wire walls, monitors of secondary emission according to synchrotron radiation, ionization of the residual gas and acoustic measuring devices) are given. The protection measures for measuring systems from external fields are shown.

**923 Energy and energy spectra measuring.** Moskalev, V.A.; Sergeev, G.I.; Shestakov, V.G. pp 65-81 of Izmerenie parametrov puchkov zaryazhennykh chastits. Moscow, USSR; Atomizdat (1980). (In Russian)

The methods for measuring energy characteristics of pulsed beams of charged particles (the total energy or momentum of the bunch, maximum and average particle beam energy, and bunch energy spectrum or beam momentum) are discussed. The operational principle of magnetic spectrometers with semicircular focusing, a spectrometer of a sector type with a homogeneous magnetic field is considered. The measuring methods of the charged particle energy according to the particle path and absorption in a material are described. The techniques of beam energy stabilization in different accelerators are given.

**924 Determination of the position of the center of gravity of a beam.** Moskalev, V.A.; Sergeev, G.I.; Shestakov, V.G. pp 108-125 of Izmerenie parametrov puchkov zaryazhennykh chastits. Moscow, USSR; Atomizdat (1980). (In Russian)

Different devices of determination of the center of gravity of a charged particle beam (BGC) in an accelerator or storage ring chamber are described. They comprise: electrostatic electrodes, magnetoinduction transformers, emission transformers, ionization and acoustic transformers, transformers of the BGC position based on countercurrent flow measurement. The scheme of determination of beam position using synchrotron radiation is shown. The output characteristics of some monitors of the BGC position are presented.

# 44 INSTRUMENTATION

## 4401 Radiation Instrumentation

*REFER ALSO TO CITATION(S) 285, 383, 395, 437, 444, 540, 907, 913, 921*

**925** (EUR—6813(Vol.2), pp 950-958) **Review of session L: dosimetry techniques.** de Leeuw-Gierts, G. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The papers of session L will be summarized, grouped in function of the subjects treated. 4 subdivisions can be made: A) neutron dosimetry materials; B) neutron dosimetry techniques; C) gamma-ray dosimetry and D) efficiency of (α,n) reaction on light elements.

926 (EUR—6813(Vol.2), pp 1031-1042) **Dosimetry characterization of a reactor pressure vessel simulator by fission chamber and foil activation measurements.** McGarry, E.D. (National Bureau of Standards, Gaithersburg, MD (USA)); Fabry, A. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

A summary is given of the significance and results of extensive dosimetry measurements in the low-power, Light-Water Reactor Pressure Vessel (RPV) Simulator at the Pool Critical Assembly. Calculated and measured neutron flux and spectral characteristics are compared for a RPV simulator that represents a clean-core calculational model with measured core-power distributions. The purpose of such a model is to validate transport theory computations needed to extrapolate into the pressure vessel dosimetry observations in the surveillance position. Also reported are investigations of the neutron field characteristics of other configurations, which were investigated to establish the design of a high-power RPV simulator to proof test the correlation of metallurgy and dosimetry results. The neutron-field characterization measurements include extensive investigation of flux level and spectrum changes, bucklings, reactor-core power linearity and stability, and neutron perturbations associated with dosimetry instrumentation, as well as those caused by insertion of the metallurgy and dosimetry surveillance capsule. Reproducibility of measurement techniques are verified by interlaboratory comparisons. The objective of high accuracy dosimetry is achieved by benchmark referencing all fission chambers and activation foils to their responses in existing standard neutron fields.

927 (EUR—6813(Vol.2), pp 1089-1090) **Report on session L - Workshop on dosimetry techniques.** de Leeuw-Gierts, G. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Verbinski, V.V. (Science Applications, Inc., San Diego, CA (USA)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

Session L was dealing with neutron dosimetry materials, neutron dosimetry techniques, γ dosimetry and the efficiency of the (α,n) reaction on light elements. Important improvements were achieved in these 4 fields, but there is still a big need for neutron detectors responding below 1 MeV.

928 (EUR—6813(Vol.2), pp 1145-1151) **Properties and application of self-powered neutron detectors.** Erben, O. (Nuclear Research Institute, Rez (Czechoslovakia)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

In the paper, a method of theoretical determination of activation component of vanadium, rhodium and silver SPN detector sensitivity on thermal and epithermal neutron flux densities is outlined. Theoretical values were experimentally verified and the effects of aluminium, stainless steel and cadmium on the detector signal were studied. Experimental results and particular components of the detector signal are presented. The application of vanadium SPN detectors to neutron flux density monitoring during irradiation experiments is described.

929 (EUR—6813(Vol.2), pp 1203-1219) **Thermoelectric neutron dosimetry: summary of recent results.** Mathieu, F.; Meier, R.; Schubert, W.; Lenders, H. (Commission of the European Communities, Brussels (Belgium)); Debrue, J.; Leonard, F.; Nihoul, J.; Delcon, M. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

The basic principles of thermoelectric dosimetry, supported by early experimental results of Pt-10% Rh/Pt and Chromel/Alumel sensors, have been exposed in a paper which has been presented at the Second ASTM-EURATOM Symposium on Reactor Dosimetry at Palo Alto, USA. At present results of sensor irradiations up to thermal and fission fluences exceeding $10^{22}$ nvt are available. They are reported in the present paper. Thermoelectric dosimetry presents many attractive features which let it appear as a competitive method for characterizing irradiation induced material degradation using appropriate sensors.

930 (EUR—6813(Vol.2), pp 1245-1252) **Fast neutron fluence measurements with the Nb-93(n,n')Nb-93m reaction and the application to long-term irradiations.** Tourwe, H.; Maene, N. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

A method was developed for the absolute determination of the activity induced in niobium dosimeters. Measured and calculated Nb-93(n,n') reaction rates are compared in a radial reflector position of the BR3 pressurized water reactor and in a core position of the BR2 high flux test reactor. The Nb-93(n.n') reaction is extensively used for fast neutron fluence determination in the pressure vessel surveillance programmes of the Belgian power plants.

931 (IA—1356, pp 303-304) **Portable nuclear level gauge using a neutron source.** Pasi, M.; Assido, C. Apr 1980. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1978 and 1979.

932 (IA—1356, pp 299-301) **Continuous level gauge for horizontal cylindrical vessels.** Keren, M.; Pasi, M.; Caras, I.; Assis, T.; Gabay, Y. Apr 1980. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1978 and 1979.

933 (IAEA-TECDOC—229, pp 23-34) **Considerations on the detection limit in measurements of low level radioactive samples.** Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna); Milu, C. (Academia de Stiinte Medicale, Bucharest (Romania). Inst. de Igiena si Sanatate Publica). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

In the framework of the coordinated research programme on "The Problems of the Radioecology of the Danube River" many problems were raised concerning the measurement of low level radioactivity concentration in the various environmental samples. The paper analyses the limits of these measurements and provides practical examples and conclusions on the relationship of radioactivity concentration and the time-length of measurements.

934 (INIS-mf—6531, pp vp) **Ceric dosimetry in radiation biology.** Matthews, R.W. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Isotope Div.). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

935 (KFTI—79-40, pp 19-22) **Low-energy α-particle spectrometer for elastic scattering studies.** Dejneko, A.S.; Storizhko, V.E. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.); Sarana, V.D.; Zalyubovskij, I.I. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

An α-spectrometer has been developed to study differential cross sections of reactions and elastic scattering of low-energy α-particles. Methods of measuring the α-spectra in elastic scattering to angles of 160 deg and 170 deg are described. A possibility of operation of surface-barrier detectors on their multiple cooling to a temperature of - 75 deg C has been investigated. The obtained energy resolution of the detectors with a constant α-source ($^{238}$Pu) constitutes approximately 16 keV. The minimum energy of spec-

trometry of α-particles in case of elastic scattering by carbon is equal to 50-75 keV, which makes it possible to measure the cross section of elastic scattering of α-particles at incident particle energies of 200-300 keV and higher. A method of spectrometer calibration by means of α-particles from a constant source is given. The developed spectrometer, together with an analyzer having a great number of channels, can be used to solve a wide variety of problems pertaining to backscattering and to reactions with escape of charged particles.

936 (KURRI-TR—190, pp 1-6) **Application of solid state track detector to detect heavy primary cosmic ray.** Doke, T.; Hayashi, T. (Waseda Univ., Tokyo (Japan). Science and Engineering Research Lab.). 1979. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on solid state track detection of radiations; Kumatori, Osaka, Japan (29 May 1978).

Observation of heavy primary cosmic ray, the nuclear charges of which are larger than that of iron (Z = 26), has been carried out since about a decade ago. Since such measurement requires to fly a large area detector for a prolonged time, solid state track detectors have been employed as useful detectors. The authors have conducted the experiment using large area (about 50 $m^2$) plastic films since 1971. In heavy primary cosmic ray observation over Japan, the detected particles are all in the relativistic velocity region, hence restricted energy loss (REL) becomes a function of Z alone, and the growing speed of etch pit V sub( t) is constant in the films. Consequently nuclear charges can be determined by measuring the constant V sub( t). The method of obtaining the relationship between V sub( t) and REL is simply described, using $^{14}N$ of 6.43 MeV/n and $^{40}Ar$ of 400 MeV/n. The plastic films used are cellulose nitrate (CN) and cellulose triacetate (CTA). The accuracy for determining nuclear charges is approximately +-2 in both CN and CTA. Next, the special construction of a balloon-borne detector is described, and the application to the mass discrimination of iron nuclei in primary cosmic ray, the mass resolution for argon and the estimation of the mass resolution for iron are reported. Determination of passing positions for heavy primary cosmic ray is also briefly described.

937 (KURRI-TR—190, pp 16-20) **Few applications of solid state track detector to reactor physics experiments.** Narita, M.; Kon, H.; Fujita, F.; Sawamura, A. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Akiyama, M. 1979. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on solid state track detection of radiations; Kumatori, Osaka, Japan (29 May 1978).

The role of solid state track detectors (SSTD) in reactor physics experiments is limited to the static measurements, as compared to activated foil method. The most successful measurement with SSTDs other than that of neutron flux and fission density distribution would be the measurement of fission ratios. Almost all SSTDs utilize the fission tracks of policarbonate and the example of recoil nuclear tracks is scarce. The authors carried out a few experiments for the purpose of directly measuring reactor physics quantities. The most significant feature of SSTDs is their excellent space resolution. Further, fission track detecting method can directly measure fission density. Paying attention to this point, the authors measured the microscopic distribution of fission density in natural $UO_2$ fuel in an natural uranium dioxide -- graphite system. From these, the diffusion length L of thermal neutrons in natural $UO_2$, the factor d of thermal neutron loss and the factor f of thermal neutron utilization were determined. Also in the fast neutron source reactor "Yayoi", measurements were performed for the following purposes: distribution of fast neutrons in the reactor core and blanket, determination of material buckling of 93% $^{235}U$ and reflector saving, recognition of the effectiveness and determination of the sensitivity of recoil nuclear track detectors, and comparison of the fission ratios obtained by fission track detectors with the activation method measuring absolute fission rate.

938 (KURRI-TR—190, pp 39-42) **Etching conditions and shape of tracks. Continuous etching with HF of 5, 10, 20 and 46%.** Kudo, S. (Tokai Univ. (Japan)). 1979. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on solid state track detection of radiations; Kumatori, Osaka, Japan (29 May 1978).

The etching effect of hydrogen fluoride (HF) solution of 5%, 10%, 20% and 46% was investigated, using the perlite dug out at Wada-toge, Japan. They were studied by the progressive etching at 30 deg C, after the perlite was subjected to thermal neutron irradiation for 8 hours in the research reactor of the Institute for Atomic Energy of St. Paul (Rikkyo) University. Observation was performed mainly by replica, and false tracks, which are difficult to be judged whether they are the tracks or not, didn't appear as far as this experiment was concerned. Measurements of etch-pits and track density were carried out. The results of these investigations were considered and analyzed to describe them in five sections. The conclusions are as follows: (1) Regarding the ease of etch-pit observation and the adjustment of etching time, etching with 5% HF solution is most advantageous among four solutions of 5, 10, 20 and 46% HF. (2) The measurement of track density is more affected by the difference in counting criteria than the difference in etching conditions. The data on the size of etch-pits are required to discuss the problems of track density and counting efficiency. (3) If linear tracks are to be observed using hydrogen fluoride, it is necessary to investigate the etching characteristics with the solution of lower concentration.

939 (KURRI-TR—190, pp 47-52) **Application of solid state track detector to neutron dosimetry.** Tsuruta, T. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1979. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on solid state track detection of radiations; Kumatori, Osaka, Japan (29 May 1978).

Though solid state track detectors (SSTD) are radiation measuring instrument for heavy charged particles by itself, it can be used as radiation measuring instrument for neutrons, if nuclear reactions such as (n, f) or (n, α) reaction are utilized. Since the means was found, which permits to observe the tracks of heavy charged particles in a solid with an optical microscope by chemically etching the tracks to enlarge them to etch pits, various types of detectors have been developed for the purpose of measuring neutron dose. The paper is described on the materials and construction of the SSTDs for neutron dosimetry, and the sensitivity is explained with mathematical equations. The features of neutron dosimetry with SSTDs are as follows: They are compact, and scarcely disturb neutron field, thus delicate dose distribution can be known; integration measurement is possible regardless of dose rate values because of integrating type detectors; it is not influenced by β-ray or γ-ray except the case when there is high energy radiation such as causing photonuclear reactions or high dose such as degrading solids, it has pretty high sensitivity; track fading is negligible during the normal measuring time around room temperature; and the etching images of tracks are relatively clear, and various automatic counting systems can be employed.

940 (KURRI-TR—190, pp 57-60) **Application of solid state track detector as an alpha-ray detector.** Kurosawa, R. (Waseda Univ., Tokyo (Japan). Science and Engineering Research Lab.). 1979. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on solid state track detection of radiations; Kumatori, Osaka, Japan (29 May 1978).

Small and simple detectors are required in the field of radiation protection, even at the cost of accuracy. Though there are not many cases in which the presence of α-ray is the problem, the importance of α-ray injury requires the reliable measurement down to low radiation levels. Hence the limit of application must be well known through sufficient number of experiments. Solid state track detectors are attractive as one of those detectors, but still have problems to be solved. In the paper, the characteristics of three kinds of cellulose acetate films as α-ray detectors are compared. In the field of radiation protection, the presence of α-ray would be of problem when Rn and its daughter nuclides are present in the air as in uranium mines, when fissionable α-emitters such as Pu or U are present, and when Ra and Th are present in water and soluble Th in the air. Since the remarkable tracks by fission fragments are employed for the measurement of Pu or U concentration, proper attention to Rn daughter nuclides will be necessary if solid state track detectors are to be applied to them. Here examples are shown on the application to the personal monitoring for the workers in uranium mines in France and the application as Rn monitors to measure the Rn concentration in residential areas and houses. In order to de-

velop a reliable device for engineering or hazardousness evaluation, considerable effort seems to be required.

941 (RL—80-043, pp 279-290) **Multiwire proportional and drift chambers: from first principles to future prospects.** Imrie, D.C. (University Coll., London (UK)). 1980. Dep. NTIS (US Sales Only).

From School for young high energy physicists; Chilton, Didcot, UK (10 Sep 1979).

An introduction is given to the basic operating principles of multiwire proportional chambers and drift chambers. The spatial resolution, time resolution, rate capability and reconstruction ability of such instruments are examined.

942 (ZfK—410, pp 126-129) **Computerisation of the γ-spectrometric method for fission yield measurement based on GAMANAL program.** Nagy, S.; Raics, P.; Daroczy, S. (Kossuth Lajos Tudomanyegyetem, Debrecen (Hungary). Kiserleti Fizikai Intezet); Erdei, K.; Rapolti, I. (Kossuth Lajos Tudomanyegyetem, Debrecen (Hungary)). Jan 1980. Dep. NTIS (US Sales Only).

From 9. international symposium on the interaction of fast neutrons with nuclei; Gaussig, German Democratic Republic (26 Nov 1979).

The principles and applicability of a system of programs capable for the routine evaluation of experimental data in the direct γ-spectrometric measurement of fission product yields is described. The main programs in the system are modified versions of GAMANAL (for automatic evaluation of γ-spectra) and CLSQ (for the flexible analysis of decay curves), supported by additional programs for the efficient data handling.

943 **Need for standardization in the field of neutron radiography.** Domanus, J.C. (Elsinore Shipbuilding and Engineering Co. Ltd. (Denmark)). pp 326 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

944 **Neutron radiographic techniques in post-irradiation examination.** Tsuruno, A. (Japan Atomic Energy Research Inst., Tokyo). pp 334 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

945 **Modification of an A-DIDA secondary ion mass spectrometer to allow the examination of α- and β/γ-emitting specimens.** Bart, G.; Aerne, E.T.; Flueckiger, U.; Sprunger, E. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). pp 358 of Post-irradiation examination. Proceedings of the conference held in Grange-over-Sands on 13-16 May 1980. London, England; British Nuclear Energy Society (1981).

From British Nuclear Energy Society conference; Grange-over-Sands, UK (13 May 1980).

946 **Real time operation of a multiple gamma measurement installation.** Philippot, J.C.; Lefevre, J. (Laboratoire 501, CEA IPSN D. Pr. Bois des Rames, Orsay, France). pp 581-588 of Measurement for progress in science and technology. Volume 3. Proceedings of the 8th IMEKO congress of the International Measurement Confederation held in Moscow, USSR, 21-27 May 1979. Solt, J.; Kemeny, T. (eds.). Amsterdam, Netherlands; North-Holland (1980).

From 8. IMEKO congress; Moscow, USSR (21 May 1979).

This paper describes a multiple measurement channel facility for fine gamma spectrometry, its real time operation, and the new possibilities which it offers. The installation is presented in its two-fold electronic and processing aspects, by considering its architecture, its hard and software, and its data processing package. Real time operation requires customized general organization, perfect instantaneous knowledge of the status of all the units, and a sound hierarchy between the various participants, operators as well as requestors. The care inherent in the installation itself and in the definition of its operation explains its new possibilities.

947 **Astro 4 - a sounding rocket programme of the X-ray astronomy.** Henkel, R.; Pechstein, H. (Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)). pp 147-153 of 5. ESA-PAC symposium on European rocket and balloon programmes and related research. Proceedings of the symposium held in Bournemouth, UK, 14-18 April 1980. Guyenne, T.D.; Levy, G. (eds.). Noordwijk, Netherlands; ESA Sci. and Tech. Publications Branch ESTEC (1980).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

The 'Astro 4' program is part of the German Astronomy Sounding Rocket Program and was divided into two different tasks. The 'Astro 4/1' project had the task to perform X-ray spectroscopic investigations and imaging of solar coronal active regions by means of zone-plate cameras, a Rowland spectrograph and a KAP crystal spectrometer aboard of a three-axis stabilized payload. The 'Astro 4/2' project had the task to take investigations of the X-ray sources Puppis A and the Crab Nebula by means of a Wolter Telescope, equipped with a position-sensitive proportional counter. Up to now the three-axis stabilized payload 'Astro 4/2' has been the longest Skylark payload.

948 **HXR80M-balloon experiment: a microprocessor-controlled transatlantic payload.** Ubertini, P.; Bazzano, A.; Boccaccini, L.; La Padula, C.; Mastropietro, M.; Medici, G.; Patriarca, R.; Polcaro, V.F. (Consiglio Nazionale delle Ricerche, Frascati (Italy). Lab. di Astrofisica Spaziale); Faggioni, F. (PULSAR, S.R.L., Guidonia (Italy)). pp 425-429 of 5. ESA-PAC symposium on European rocket and balloon programmes and related research. Proceedings of the symposium held in Bournemouth, UK, 14-18 April 1980. Guyenne, T.D.; Levy, G. (eds.). Noordwijk, Netherlands; ESA Sci. and Tech. Publications Branch ESTEC (1980).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

Following the results obtained from the successful transatlantic flight launched during the summer 1976 from the CNR Milo Base, Sicily, the Laboratorio di Astrofisica Spaziale has started a new program in the hard X-ray astronomy field. It basically consists in the development of high resolution large area Multiwire Proportional Chambers to be employed in long duration balloon flights to study and monitor galactic and extragalactic sources. The authors describe the flight configuration and performances of the HXR80M payload. The experiment is expected to fly during July 1980 from the Milo Base in the framework of the CNR experimental balloon campaign. The authors analyze the main characteristics of the detectors employed, of the data handling electronics and in particular of the hardware and the software of the on-board microprocessor controlled multichannel analyzer. In fact the limitation due to the low bit rate HF link (1.2Kbit/s) and the long flight duration (about one week) make imperative the use of an onboard microprocessor system to handle and select in real time the scientific data and to control the housekeeping and the telecommand systems.

949 **Image photon counting system for space astronomical observations.** Gardier, S.; Jamar, C.; Macau, J.P.; Monfils, A. (Liege Univ. (Belgium). Inst. d'Astrophysique). pp 435-443 of 5. ESA-PAC symposium on European rocket and balloon programmes and related research. Proceedings of the symposium held in Bournemouth, UK, 14-18 April 1980. Guyenne, T.D.; Levy, G. (eds.). Noordwijk, Netherlands; ESA Sci. and Tech. Publications Branch ESTEC (1980).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

The two main categories of published image photon counting systems (parallel output and serial output) are briefly reviewed. The modified IAL image photon counting method is then described. It is based, as was the first version, on a pattern recogni-

tion logic and as such is truly bi-dimensional. In the presented version, the flexibility, aiming at the simultaneous detection of adjacent events of the former, has been exchanged for a better adaptability to the observed pulse width distribution function. The logical circuitry is described as well as the newly developed pulse analyzer.

950 **Scanning ion source for static SIMS and depth profiling.** Tuempner, J.; Ganschow, O.; Benninghoven, A. (Muenster Univ. (Germany, F.R.). Physikalisches Inst.). pp 118 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

951 **Use of informatic for radiation control panels.** Coehinal, R.; Grimont, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Mai, V. (Etablissements Merlin et Gerin, 38 - Grenoble (France)). pp 736-738 of Radiation protection. A systematic approach to safety. Oxford; Pergamon Press (1980).

Developments in radiation protection systems which have occurred within the CEA are described. Such systems enable irradiation and contamination risks to be quantitatively determined and monitored. A monitoring station is defined to be a suitable radiation detector (with its associated electronics) and audible and visible means of alerting personnel. The outputs from all the monitoring stations are fed to a central control station where they are recorded and acted upon. The practical experience obtained using microprocessors on the monitoring stations and a minicomputer in the central station is discussed; 30 units are connected to the central minicomputer in order to control an effluent treatment plant.

952 **Secondary standard dosimetry system with automatic dose/rate calculation.** Duftschmid, K.E.; Bernhart, J.; Stehno, G.; Kloesch, W. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Forschungszentrum); Hizo, J.; Zsdanszky, K. (Orszagos Meresuegyi Hivatal, Budapest (Hungary)). pp 739-742 of Radiation protection. A systematic approach to safety. Oxford; Pergamon Press (1980).

The novel design of a versatile and automated secondary standard ionization chamber is described. It is intended for use in radiation protection and therapy level dosimetry and provides a quick and accurate dose or dose rate measurement in a wide range of radiation intensity and quality. The ionization chamber uses walls and electrodes made from polyacetal resins, thus providing long term stability of dimensions. By adding teflon and small amounts of higher Z-material, chambers can be made tissue, water or air equivalent. The energy response for $\gamma$ rays is +- 2% between 0.02 and 1 MeV. The output is connected to a precision digital current integrator with microprocessor circuitry for data evaluation and control. The system can cover a wide range of measurement between 1 $\mu$R and 100 kR, and is useful for daily measurements in a secondary standard dosimetry laboratory or radiotherapy centre.

953 **Measurement of absorbed dose-rate in skin for low-level beta-rays.** Shinohara, K.; Kishimoto, Y.; Kitahara, Y.; Fukuda, S. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). pp 755-758 of Radiation protection. A systematic approach to safety. Oxford; Pergamon Press (1980).

A $\beta$ ray absorbed dose-rate meter is described for use in measuring the absorbed dose in the skin from contaminated sandy beaches. It consists of a plastic scintillator and pulse height analyser in order to obtain the best correlation between the instrument response and absorbed dose. Practical measurements are shown to be in agreement with theoretical calculations for various depths of dry sand. The measured dose appears to be almost entirely due to the naturally occurring radionuclide $K^{40}$. It is concluded that the absorbed dose-rate meter has relatively high stability and sensitivity to measure skin doses and a program for future studies is outlined.

954 **'Intelligent' radiation instruments.** Ward, A. (Strathclyde Univ., Glasgow (UK)). pp 763-765 of Radiation protection. A systematic approach to safety. Oxford; Pergamon Press (1980).

A description is given of three applications of current microprocessor technology to instruments used in the field of radiation protection. In the first application, the ratio of counts between an unshielded and a shielded geiger counter is continuously monitored to derive an estimate of the incident $\gamma$-ray energy and hence the dose rate. In the second example, the microprocessor acts as a multi-channel analyser on the output pulses from a scintillation detector with simple pattern recognition of $\gamma$-ray lines. The final application concerns the routine calibration of radiation monitors, particularly those calibrated to record high dose rates, where the method described results in very little radiation dosage to personnel.

955 **Simple method for collection of HTO from air.** Auf der Maur, A.N.; Lauffenburger, T. (Swiss National Accident Insurance Fund (SUVA), Lucerne (Switzerland). Physics Section). pp 877-880 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A simple rapid method is described for determining the tritium contamination of the air (in the form of HTO) in luminous paint plants. Air is collected in a soft plastic half litre bottle by squeezing the bottle ten times and adding 10 ml water to absorb the HTO into the water phase; the tritium concentration is subsequently determined by liquid scintillation counting. This method of measuring HTO was compared to an alternative method which freezes the atmospheric moisture; good agreement between the two methods was achieved in the range 30 $nCim^{-3}$ to 10 $\mu Cim^{-3}$. Although the freezing method is nearly three times more sensitive, the bottle method is simpler, faster and adequate for quick checks in laboratories or the environment in determining whether the air concentration of HTO is above or below the legal limit.

956 **Detection efficiency of scintillator gels.** Chauvet-Deroudilhe, M.; Dell'Amico, M.; Bordeaux, M.; Briand, C. (Laboratoire de Physique Pharmeutique, Marseille (France). Faculte de Pharmacie). pp 899-902 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980). (In French)

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A study was performed to determine whether the increased counting efficiency of gel scintillants (containing dioxan, PPO, dimethyl POPOP and naphthalene) with the addition of increasing amounts of silica could be due to increased fluorescence from PPO resulting from the increasing viscosity. This was tested by studying a series of gel scintillants of the same composition but containing no silica; an increasing viscosity was obtained by adding different quantities of liquid $HP_{55}$ (hydroxypropyl-methyl-phthalate cellulose). The overall results with the scintillants containing HP showed a decreased fluorescence from PPO with increasing viscosity. However this was a result of two opposing mechanisms, i.e. an increased fluorescence from PPO due to increased viscosity and a direct quenching effect of $HP_{55}$, the latter effect being predominant. The importance of the viscosity was thus confirmed, raised values leading to increased fluorescence from PPO and thus increased scintillation counting efficiency. A further study was made of other gel scintillants containing silica.

957 **Passive monitor for radon using electrochemical track etch detector.** Massera, G.E.; Hassib, G.M.; Piesch, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). pp 915-918 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A passive, inexpensive monitor for radon detection and dosimetry is described in detail. It consists of a Makrofoil track etch detector inside a diffusion chamber which is sealed by a fibreglass filter through which radon may diffuse while radon daughters and

aerosols are retained on the surface of the filter. The $\alpha$-particle tracks are revealed by etching the Makrofoil in KOH. The lower detection limit of the radon dosimeter is equivalent to a mean dose in the lung of 130 mrem. After an exposure period of 3 months, a mean radon concentration of 0.3 pCi/l can be detected. The instrument is intended for use in a study to measure the long-term radon exposure in buildings in West Germany.

958 **Beta dosimetry with surface barrier detectors.** Heinzelmann, M.F.M.; Schuren, H.; Dreesen, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). pp 919-922 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A small dosimeter to measure the dose rate due to $\beta$-radiation in an energy independent fashion is described in detail. A surface barrier semi-conductor detector is used whose thickness of sensitive layer is changed by varying the detector voltage. The integral count rate can then be determined as a function of applied voltage and discrimination thresholds. The integral count rate can be related to $\beta$ dose rate in an energy independent fashion only for a time constant of 0.25 $\mu$s. However, the use of a single channel analyzer permits an energy-independent determination of the $\beta$-dose rate with 0.25 or 0.5 $\mu$s time constants. The sensitivity of the device as a function of dose rate is investigation up to 600 rad/hr. Furthermore, the sensitivity of the device at a constant dose rate was shown to be uniform up to a dose of 50,000 rads.

959 **Calibration of radiation protection instruments at SSDL level in Israel.** Kuszpet, M.E.; Donagi, A. (Ministry of Health, Jerusalem (Israel)); Schlesinger, T. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). pp 927-930 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The calibration of radiation protection instruments in Israeili at a secondary standard dosimetry laboratory is described. The anode current and voltage in a X-ray tube are variable and capable of a constant output of +- 1% and the resulting X-ray beam is filtered by Pb, Sn, Cu or Al; thus a wide range of intensities and radiation qualities is available. The reference instrument is an NPL Protection Level Secondary Standard Dosimeter and all measurements are performed relative to its response. The instrument under test is evaluated for energy response, linearity, saturation characteristics, directional dependence, temperature dependence, overlord characteristics, $\beta$ response, neutron response and transient characteristics. Results are given for some typical instruments and possible problems highlighted. The future expansion of the standards section is discussed with respect to neutron sources and $\beta$-radiation.

960 **Decontamination and modification of liquid scintillators.** Sachan, S.R.; Soman, S.D. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). pp 947-950 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

New techniques of decontaminating and recycling used radioactive liquid scintillators (LS) are discussed. Aromatic LS Tritel spiked with tritiated water was decontaminated with NaOH; single extraction gave a decontamination factor of about 90% and 3-4 extractions decontaminated the LS to background level. The counting efficiency of the decontaminated LS was about 88% of the fresh LS. A modification of hydrophobic toluene LS for use with aqueous samples is also described. The water holding capacity (WHC) of modified toluene/alcohol LS decreased while the counting efficiency increased with increasing concentration of toluene in LS; an optimum working range of around 50% toluene concentration was selected. The decontamination of used modified LS was achieved by a single washing with an excess amount of water. The counting efficiency of decontaminated LS was about 92% of the fresh LS. This recycling of used liquid scintillators after decontamination will not only save expenditure on LS but also help waste disposal problems as the radioactivity is contained in aqueous phase with reduced volume.

961 **Tritium - is it underestimated.** Whitlock, G.D. (Hughes Whitlock Ltd., Malvern (UK)). pp 951-954 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Practical experience of using the Whitlock tritium monitor for the measurement of surface contamination in various laboratories and industrial establishments throughout the world is reported. It is claimed that a) smear or wipe tests can underestimate surface contamination of tritium by up to a factor of 1000, b) sub-visual scratches (8 $\mu$m deep) are radiologically important and c) volatile forms of tritium exist in 20 to 30% of the establishments visited.

962 **Possibility of isotope separation in primary cosmic ray using plastic films.** Doke, T.; Hayashi, T. (Waseda Univ., Tokyo (Japan). Science and Engineering Research Lab.); Yanagimachi, T.; Kobayashi, S. pp 50-57 of Daikikyu shinpojiumu, Showa 53. Tokyo, Japan; Tokyo Univ., Inst. of Space and Aeronautical Science (Mar 1979). (In Japanese)

From Symposium on large balloons; Tokyo, Japan (21 Dec 1978).

963 **Etching and annealing behaviour of glass nuclear track detector.** Khan, A.; Ahmad, M.M.; Srivastava, D.S. (Z.H. Coll. of Engineering and Technology, Aligarh (India)). pp 302-304 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

964 **Effect of annealing on fission fragment tracks in soda glasses.** Singh, V.P.; Gomber, K.L.; Yadav, J.S.; Sharma, A.P. (Kurukshetra Univ. (India). Dept. of Physics). pp 305 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

965 **Etching behaviour of a soda glass detector.** Gomber, K.L.; Yadav, J.S.; Singh, V.P.; Sharma, A.P. (Kurukshetra Univ. (India). Dept. of Physics). pp 306 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

966 **Etch induction time in diacel plastic track detector.** Maurya, A.L.; Bose, S.K.; Tuli, S.K. (Banaras Hindu Univ. (India). Dept. of Physics). pp 307-308 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

967 **Sensitivity enhancement of glass detectors.** Yadav, J.S.; Singh, V.P.; Gomber, K.L.; Sharma, A.P. (Kurukshetra Univ. (India). Dept. of Physics). pp 309 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

968 **KCl crystal for dosimetry of hard X-ray and gamma radiation.** Pakhomov, P.L.; Skul'skaya, M.I. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 117-119 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Dependence of transmission coefficients for KCl crystals coloured with hard X-ray and gamma radiations on an exposure dose value has been investigated. It is established that the drop of the transmission coefficient T with the growth of the dose has a linear nature up to an order of 500-600 R values for X-ray radiation, during the usage of gamma radiation - up to 1000 R. The drop occurs considerably slower than in the case of X-ray radiation. Owing to the simplicity and cheapness of the method the KCl detectors are expedient to use in experiments to estimate the order of a dose value.

969 **Constant velocity Moessbauer spectrometer free of long-term instrumental drifts in the count rate.** Sarma, P.R.; Sharma, A.K.; Tripathi, K.C. (Nuclear Research Lab., Srinagar (India)). pp 807 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, England; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

Two new control circuits to be used with a constant velocity Moessbauer spectrometer with a loud-speaker drive have been described. The wave-forms generated in the circuits are of the staircase type instead of the usual square wave-form, so that in each oscillation of the source it remains stationary for a fraction of the time-period. The gamma-rays counted during this period are monitored along with the positive and negative velocity counts and are used to correct any fluctuation in the count rate by feeding these pulses into the timer. The associated logic circuits have been described and the statistical errors involved in the circuits have been computed.

970 **NQR spectrometer with AGC and sideband suppression.** Rukmani, K.; Ramakrishna, J. (Indian Inst. of Science, Bangalore. Dept. of Physics); Chary, S.L.V. (Indian Inst. of Science, Bangalore. Central Instruments and Services Lab.). pp 811-813 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, England; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

A conventional super-regenerative oscillator used for NQR investigations suffers from two major drawbacks viz. (i) the gain of the oscillator varies with both the quench frequency and the oscillator frequency, (ii) the oscillator gives rise to sidebands on either side of the main line. Several methods for overcoming these are described in the literature. The details of a NQR spectrometer to overcome these defects, following Smith and Tong are presented. The spectrometer is completely solid state except for the SRO, and uses mainly integrated circuits. The oscillator is externally quenched by rectangular pulses. The height and/or width of these pulses can be adjusted automatically with the help of a negative feedback loop, so that the gain is maintained constant. A sample of the output noise is rectified and compared with a reference, the difference being the error voltage which adjusts the gain and holds it constant. The sidebands appear at intervals of the quench frequency on either side of the main line; hence if the quench frequency is modulated, the main line is unaffected whereas the intensity in the sidebands gets smeared out. In the instrument five different depths of quench frequency modulation are available.

971 **Single klystron superhet, E.S.R. spectrometer for low level and low frequency modulation.** Manjunath, C.V.; Mishra, N.C.; Sinha, S.; Srinivasan, R.; Venkataratnam, P. (Indian Inst. of Science, Bangalore. Dept. of Physics). pp 814-816 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, England; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

ESR at high hydrostatic pressure requires low frequency magnetic field modulation for effective penetration through the pressure vessel. ESR and ENDOR at liquid helium temperatures also require low frequency modulation of the magnetic field due to long relaxation times as well as low incident microwave power. To meet the requirements for these two techniques, a superhet spectrometer which is effective and avoids the complexity of two klystron spectrometers while permitting an i.f. frequency in the kilchertz range has been constructed. An ECIL PIN modulator used in the reflection configuration has been used to modulate the power in the signal channel. The detector is biased by unmodulated power conveyed through a bucking arm via phase shifter and attenuator. Using any i.f. in the range from 70 to 500 Khz has proved effective. Signal to noise ratios of the ESR signals have been found to be independent of magnetic field modulation in the range from 87 Hz to 100 Khz. Details of the construction and performance of this spectrometer are presented.

972 (INIS-mf—6422, pp vp) **Radiometric determination of bulk density of suspensions by the absorption method.** Kubicek, P. (Vysoka Skola Banska, Ostrava (Czechoslovakia)); Mrazek, L. (Vyzkumny Ustav Hutnictvi Zeleza, Dobra (Czechoslovakia)); Valek, J. (Vedecky Vyzkumny Uhelny Ustav, Ostrava (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

973 (INIS-mf—6422, pp vp) **Radiometric gage for ash content monitoring in solid fuels.** Sojka, J.; Kominek, A. (Vyzkumny Ustav Stavebnich Hmot, Brno (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

## 4403 Miscellaneous Instruments

*REFER ALSO TO CITATION(S) 5, 283, 873, 874, 875, 876, 878*

974 (IA—1356, pp 306-307) **New electron gun for the S-600 scanning electron microscope.** Admon, U.; Taragan, E.; Golan, M.; Atar, E.; Lichtenstein, M.; Elgat, Z. Apr 1980. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1978 and 1979.

975 **Use of indexed sensitivity factors in the analysis of nickel and iron based alloys. A study of the decalibration of sheathed Chromel/Alumel thermocouples.** Christie, W.H. (Oak Ridge National Lab., TN (USA)). pp 17-22 of Secondary ion mass spectrometry. Fundamentals and applications. Someno, M. (Tokyo Inst. of Tech. (Japan)); Wittru, D.B. Tokyo, Japan; Riaru-Kogeisha Ltd. (Mar 1979).

From 2. Japan-United States joint seminar on secondary ion mass spectrometry; Takarazuka, Hyogo, Japan (23 Oct 1978).

Sheathed Chromel versus Alumel thermocouples decalibrate when exposed to temperatures in excess of 1100°C. Thermocouples sheathed in Inconel-600 and type 304 stainless steel were studied in this work. Quantified SIMS data showed that the observed decalibrations were due to significant alterations that took place in the Chromel and Alumel thermoelements. The amount of alteration was different for each thermocouple and was influenced by the particular sheath material used in the thermocouple construction. Relative sensitivity factors, indexed by a matrix ion species ratio, were used to quantify SIMS data for three nickel-based alloys, Chromel, Alumel, and Inconel-600, and an iron-based alloy, type 304 stainless steel. Oxygen pressure $> 2 \times 10^{-6}$ torr in the sputtering region gave enhanced sensitivity and superior quantitative results as compared to data obtained at instrumental residual pressure.

## 4404 Well Logging Instrumentation

976 **Radiometric and nuclear geophysics methods.** Matolin, M. pp 148-231 of Introduction to applied geophysics. Mares, S. Prague, Czechoslovakia; SNTL - Nakladatelstvi Technicke Literatury (1979). (In Czech)

A review and detailed description are given of radiometric methods applied in geology and nuclear geophysics, including methods used for measuring natural radioactivity. The methods are classified depending on the type of radiation to be detected and on the technique of radiation measurement. Field methods described include gamma-gamma methods, X-ray fluorescence analysis, the nuclear gamma resonance method, the gamma-neutron method, the neutron-neutron method, and neutron activation analysis. Laboratory methods are also discussed which are used for determining the content of elements in rocks, the physical properties of rocks, and allow a correlation to be made of field measurements.

977 **Nuclear logging methods.** Mares, S. pp 481-495 of Introduction to applied geophysics. Mares, S. Prague, Czechoslovakia; SNTL - Nakladatelstvi Technicke Literatury (1979). (In Czech)

A detailed review is presented of nuclear logging methods, including gamma logging, spectral gamma logging, X-ray fluorescence logging, gamma-gamma methods, gamma-neutron, and neutron-neutron methods, pulse neutron and activation logging. The applications of the methods are given.

978 (INIS-mf—6422, pp vp) **Development of standard series of radiometric probes for ore logging.** Dana, J.; Skolka, J. (Geoindustria, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

# 50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

## 5001 Basic Studies

*REFER ALSO TO CITATION(S) 995*

979 (IA—1356, pp 278-279) **Structure of flow and turbulence in the stable atmospheric surface layer.** Skibin, D. Apr 1980. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1978 and 1979.

980 **(NP—2900749) Climate impact assessment: United States.** (National Oceanic and Atmospheric Administration, Washington, DC (USA). Center for Environmental Assessment Services). Oct 1981. 30p. National Oceanic and Atmospheric Administration, Washington, DC. 20235. Order Number DE82900749.

Data and maps are presented, illustrating events and impacts of weather during October 1981. Texas, Oklahoma, and Hawaii suffered substantial personal and financial losses, as the result of this months heavy rains. Long-term lack of rain has had an effect in the eastern United States. Water supplies for crops, livestock and drinking were in short supply. Large weekly temperature departures from normal lead to a $500 million increase in utility bills for the nation. No other significant impacts were assessed. Railroad transport indices are presented for the month of October 1981. An assessment of the Chesapeake Bay marine environment and the impacts of weather on Bay fisheries, recreation, and transportation is also included. (JGB)

## 5002 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 845, 993, 1005*

981 (IA—1356, pp 280-281) **Reduction of the environmental concentration of air pollutants by proper geometrical orientation of industrial line sources.** Tadmor, J. (Israel Atomic Energy Commission, Tel Aviv); Eisner, A. (Hebrew Univ., Jerusalem (Israel)). Apr 1980. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1978 and 1979.

982 **Impact of residential wood combustion on urban air quality: first ambient measurements.** Cooper, J.A.; Currie, L.A.; Klouda, G.A. Pittsburgh, PA; Air Pollution Control Association (1980). 13p. (CONF-800608—9).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

The impact of wood burning stoves and fireplaces on urban air quality was measured for the first time and determined to be a significant source of respirable air particulates. One half (34 $\mu g/m^3$) of the respirable air particulates in a residential area of Portland, Oregon, were found to have originated from wood combustion sources. The impact was determined using new low-level counting methods to measure biogenic carbon-14 and recently improved chemical mass balance methods. These results are of concern because of expected increases in these emissions and because they are highly respirable, contain known carcinogens and significantly reduce visibility. In addition, these sources can be used for trash incineration and coal combustion. The methods and results of this study will be discussed as well as their implications. The body of information presented is directed to those individuals concerned with identification of air pollution sources and their control, and the environmental impact of energy sources.

983 **Characterization and control of utility emissions.** Pittsburgh, PA; Air Pollution Control Association (1980). 88p. (CONF-800608—(Vol.1)).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

Individual papers are included in the database. (PSB)

984 **Removal of SOx and NOx from flue gases by electron radiation.** Shui, V.H. (Avco Everett Research Lab., Inc., MA); Kawamura, K. pp 4.1-4.15 of Characterization and control of utility emissions. Pittsburgh, PA; Air Pollution Control Association (1980).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

Based on the experimental data described in earlier publications and in this paper, electron radiation with ammonia addition offers considerable promise for the economic removal of SO/sub x/ nd NO/sub x/ from flue gases. The potential for applying this process to coal-fired combustion gases is good, as indicated by the >90% simultaneous SO/sub x/ and NO/sub x/ removal efficiencies at SO/sub x/ = 1900 ppM and NO/sub x/ = 620 ppM, the lack of adverse effect of fly ash, and the expected cost advantages over wet lime scrubber system. While the process has been successfully piloted on a low SO/sub x/, low NO/sub x/ flue gas the next step in scale-up should demonstrate performance on a pilot plant operating on coal-fired combustion gases. Avco and Ebara are collaborating on achieving this next step toward commercialization.

985 **Impact study of a primary sulfate emission source.** Stansfield, J.M.; Wuebber, B.R. (York Research Corp., Stamford, CT). pp 6.1-6.15 of Characterization and control of utility emissions. Pittsburgh, PA; Air Pollution Control Association (1980).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

A field program was carried out to obtain the necessary data to characterize the local variation in ambient sulfate concentrations. This field program was crried out during the period from mid-September to mid-October, 1978. The primary sulfate emission source selected was Niagara Mohawk's Albany Steam Plant which is located on the Hudson River just South of Albany, New York. In addition to the data collected by the contractor during the field study, data were also obtained from the New York State Depart-

ment of Environmental Conservation. These ambient data were examined both geographically and temporally. This examination indicates that there are subregional and local variations in the observed ambient sulfate levels.

## 5003 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 1189*

986 (IA—1356, pp 288) **Radioactive fallout in Israel 1976-1978.** Dukhan, R.; Shamai, Y.; Schlesinger, T. Apr 1980. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1978 and 1979.

987 (KURRI-TR—179, pp 20-22) **Rare gas especially $^{41}$Ar released from research nuclear reactor and its in-situ measurement, (1).** Komura, K. (Kanazawa Univ. (Japan). Faculty of Science). 1978. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on the state of natural radioactivities in the environment; Kumatori, Osaka, Japan (22 Mar 1978).

The gaseous radionuclides, which are produced by neutron capture and fission reaction in nuclear reactors and are released to the atmosphere through stacks, were investigated. In this connection, the kinds of nuclides, the half life time, the decay mode like $\beta^-$, EC and IT, the major $\gamma$-ray energy, the production reaction, the target abundance, the cross section and the fission yield are given. The main nuclides contributing to the spatial dose are rare gases $^{41}$Ar, Xe and Kr. The spatial dose due to plume was calculated as the function of stack height, the distance from a stack, the amount of release, the release mode like continuous or intermittent, the $\gamma$-ray energy, the half life time, wind direction, wind velocity, solar radiation and atmospheric stability. The examples of measurement about the contribution from plume in BWRs and PWRs are presented. The results of measurement of $^{41}$Ar released from the KUR, utilizing a Ge (Li) detector, are explained and evaluated. The insitu Ge (Li) spectrum data are shown, which were taken at 100 m from the stack of the KUR on November 25 and 26, 1976. In these data, the 1293 keV peak line of $^{41}$Ar was recognized together with the small peak lines of fission products, $^{103}$Ru, $^{95}$Zr, $^{95}$Nb and $^{137}$Cs. Also the correlation between wind direction and the exposure rate due to $^{41}$Ar is shown and evaluated. The measured exposure rate was 0.03 to 0.13 $\mu$R/hr, utilizing the Ge (Li) detector which has the sensitivity of 0.01 to 0.02 $\mu$R/hr. It is recommended to measure with two kinds of detectors at the same time to increase the measuring reliability.

988 (KURRI-TR—179, pp 23-27) **Rare gas especially $^{41}$Ar released from research nuclear reactor and its in-situ measurement, (2).** Yoshimoto, T. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1978. (In Japanese). Dep. NTIS (US Sales Only).

From Meeting on the state of natural radioactivities in the environment; Kumatori, Osaka, Japan (22 Mar 1978).

The rare gas, especially $^{41}$Ar, which is released from the research nuclear reactor KUR, was measured and evaluated. The KUR is the light water-moderated reactor fueled with 90% enriched uranium, and has the thermal output of 5000 kW. The core is set in the aluminum tank with 2 m diameter and 8 m height. The experimental apparatuses consist of eight irradiation holes, one penetrating hole and two thermal neutron experimental facilities. The rare gas $^{41}$Ar is produced due to the irradiation of leaking neutrons to $^{40}$Ar in the air and $^{40}$Ar resolved in the core tank water. The calculated results of the $^{41}$Ar production are presented for each experimental apparatus. As for the diffusion of $^{41}$Ar released from the KUR in the atmosphere and the evaluation of exposure dose, the ventilation system of the KUR is shown with the flow diagram, and the actual measured rate of released $^{41}$Ar at the outlet of the stack is also presented with wind speed and direction data. The exposure dose at the point 400 m apart from the outlet was estimated, using the measured release data and meteorological data, by the superposing method. It is recognized that the values are larger than those by the meteorological guide line on safety analysis. The insitu $\gamma$-spectrometry of the KUR was carried out, utilizing a NaI (Tl) detector, an ionization chamber and a Ge (Li) detector. The measured data and the evaluation of $^{41}$Ar utilizing a NaI (Tl) detector are presented here, including the temperature effect of the detector on the spectra, the count rate fluctuation in long time range and the continuously measured released irradiation dose of $^{41}$Ar.

989 **Protective action guides. Theory and application lessons from the Three Mile Island accident.** Shleien, B. (Department of Health, Education, and Welfare, Rockville, MD (USA)). pp 685-689 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The role of the Food and Drug Administration (FDA) in ensuring a safe food supply during the aftermath of Three Mile island (TMI) Nuclear Accident is described. Two aspects of the FDA's role are discussed in detail. Firstly, actions related to the use and availability of potassium iodide as a thyroid blocking agent are outlined; dose regimens and durations are detailed. Secondly, the Protective Action Guidance to be followed in the event of radioactive contamination of the food pathways relative to human food and animal feeds are discussed. The maximum $I^{131}$ levels detected at TMI were 300 times smaller than the preventative action level. Salient points from the experience of TMI are noted and future courses of action indicated.

990 **Discussion of an environmental dose methodology to obtain compliance with dose limits in the case of postulated accidents.** Brenk, H.D. (Environmental Systems Engineering, Aachen (Germany, F.R.)); Vogt, K.J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). pp 790-793 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A method is described for evaluating the environmental dose resulting after radioactive release from an accident in a nuclear facility. The technical design of the plant can then be such that for the worst accident, the individual annual dose will be kept below legal requirements. For dose assessment purposes, the calculation divides the ecosphere into three compartments - atmosphere, biosphere and man. These compartments are then treated independently to derive an overall dose. A detailed discussion of each compartment of the model, together with its systematic errors, is given. It is claimed that the model is simple, open to verification by measurement, conservative in its dose assessments and also represents a considerable reduction in computational efforts.

991 **Occupational exposures associated with laser heat sealers.** Bradley, F.J.; Schuster, L.; Cabasino, L. (New York State Dept. of Labor (USA)); Tedford, C.; Warren, D.; Fitzrandolph, L. (Arizona Atomic Energy Commission, Phoenix (USA)). pp 44-47 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A summary report is presented of problems met following the introduction of a 175 W, $CO_2$ laser heat sealer at a plant fabricating tritium gas tubes in Tuson, Arizona, in September 1978. In December, 1978, higher than normal tritium levels in rainwater/snow samples one mile from the plant were reported (0.9 to 20 pCi/cm$^3$, compared with 0.1 to 0.3 pCi/cm$^3$ of rain/snow at other stations in the same nuclear power station monitoring net). At the same time, air, smear and urine sampling indicated widespread contamination at all fabrication levels, and there was a decrease in the purity of tritium gas from 98 +% $T_2$ to 92 +% $T_2$. Air samples representing the HTO concentration, taken in the Transfer Room and Quality Control area were 360 pCi,T/cm$^3$ and 12 pCi/cm$^3$ respectively. The occupational collective doses for a 12 month period were as follows: transfer and filling step: 24 man-rem; laser cutting: 8 man-rem; quality control: 36 man-rem, and assembly: 650 man-rem. Worker exposures varied from one to 52 weeks. The plant license to operate was cancelled in July 1979. From 1976 until then, the plant received a total of 2,200,000 ci,T and shipped as finished light sources 1,000,000 CiT. Accidental losses were 32,000 Ci,T; in addition 380,000 Ci,T were in rejected tubes, now stored. About 97,000 Ci,T remain in plant: the remaining approximately 400,000

Ci,T was shipped off-site as waste or is unaccounted for. Doses to residents within one mile of the plant represented 2% of the maximum permissible dose for a member of the population. Tritium contamination was found in local swimming pools, school lunches and vegetation, particularly cactus. It is concluded that sealing tritium intubes with a laser in quantities above 50,000 Ci, T/year creates problems not anticipated, and that it is necessary to assume that laser cutting will produce tritium oxide, causing extensive contamination unless means are employed for its containment at the source.

992 **Study and measurement of the atmospheric pollution by $^{85}$Kr.** Eggermont, G.; Buysse, J.; Janssens, A.; Raes, F. (Ghent Rijksuniversiteit (Belgium). Lab. voor Kernfysica). pp 903-906 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A method is described for measuring low $^{85}$Kr activities released into the air by reprocessing plants. The results of a large number of atmospheric measurements performed in Ghent during 1979 are presented and discussed. During the year, the base line of the $^{85}$Kr activity was constant at about 0.70 Bq m$^{-3}$. This represents an increase in $^{85}$Kr background when compared to 0.46 Bq m$^{-3}$ in 1971 and 0.67 Bq m$^{-3}$ in 1977; this is thought to be related to the increased world reprocessing of nuclear fuel. During 1979, a number of peak measurements were observed which are likely related to the transport of released activities from reprocessing centers. Future studies on the climatological impact on $^{85}$Kr are indicated.

993 **Atmospheric dispersion study with $^{85}$Kr and $SF_6$ gas.** Narita, O.; Kishimoto, Y.; Kitahara, Y.; Fukuda, S. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). pp 931-934 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

An atmospheric dispersion study was performed with $^{85}$Kr and $SF_6$ gas released from a reprocessing plant. The method of charcoal absorption was used to measure concentrations of $^{85}$Kr down to $10^{-9}\mu$Ci/cm$^3$ in the 5 km vicinity of the plant. From the results, it is concluded that atmospheric diffusion profiles under stable conditions were in good agreement with calculations using a Gaussian plume model. However, in unstable conditions, the agreement was poor and the relative cross-wind integrated concentrations are clearly displayed. Results are also displayed for the atmospheric diffusion parameters. Finally, there was a good correlation between the dilution factors for $^{85}$Kr and $SF_6$.

994 **Monitoring of environmental radon-222 in selected areas of Taiwan Province of the Republic of China.** Mei, T.Y.C. (Institute of Nuclear Research, Lung-Tan, Taiwan (Republic of China). Div. of Health Physics); Wu, G.F.; Weng, P.S. (National Tsing Hua University, Hsinchu, Taiwan (Republic of China). Div. of Health Physics). pp 1119-1122 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The radon-222 concentrations in air sampled from selected areas of Taiwan including a radioactive waste plant, a storage room for uranium, a natural cave, rooms using and not using natural gas are measured. Continuous air sampling of the environment was also performed at the Tsing-Hua open-pool reactor site for six months. The annual dose equivalent of $^{222}$Rn at the reactor site was estimated to be 29.6 mSv/y (indoor) and 13.8 mSv/y (outdoor).

995 **Proceedings of the seminar on radioactive releases and their dispersion in the atmosphere following a hypothetical reactor accident, Risoe, 22-25 April 1980.** Luxembourg; CEC (1980). vp. (In German). (CONF-8004121—(Vol.2)). Dep. NTIS (US Sales Only).

From European seminar on radioactive releases and their dispersion in the atmosphere following a hypothetical reactor accident; Riso, Denmark (22 Apr 1980).

Selected papers were processed for inclusion in the data base.

996 **Plutonium in the environment: a review.** Harley, J.H. (Department of Energy, New York (USA). Environmental Measurements Lab.). pp 1-36 of Invited papers presented to the international sessions at the 1979 annual meeting of the Japan Radiation Research Society. Chiba, Japan; Japan Radiation Research Society (1979).

From Annual meeting of the Japan Radiation Research Society; Osaka, Japan (23 Nov 1979).

The plutonium that will be produced in the nuclear fuel cycle is a matter of extreme importance to regulators and to members of the public concerned with the environment. At the present time there is plutonium present in the environment on a global scale from weapons testing and from a satellite failure and on a local scale from nuclear operations and from the loss of nuclear weapons. The sensitivity of plutonium measurement has allowed us to study the present environmental levels of plutonium in the atmosphere, on the ground, in the oceans and in the pathways leading to man. This information, in turn, may allow us to predict the probable distribution of this material from any future contamination. Since the present levels from even local contamination are low, it is desirable to be able to distinguish among the various sources, particularly distinguishing local sources from global fallout. When plutonium-238 is involved, alpha spectrometry can provide the contribution from this source. When the question involves the 239/240 ratio, mass spectrometry is necessary and only very high quality mass spectrometry is adequate for environmental levels of plutonium. This paper will review our present knowledge of environmental plutonium and give some examples of problems where it has been necessary to distinguish among the various plutonium isotopes.

997 **Radioactive fallout in the southern hemisphere from nuclear weapons tests.** Moroney, J.R. (Australian Radiation Lab., Melbourne). pp 59-98 of Invited papers presented to the international sessions at the 1979 annual meeting of the Japan Radiation Research Society. Chiba, Japan; Japan Radiation Research Society (1979).

From Annual meeting of the Japan Radiation Research Society; Osaka, Japan (23 Nov 1979).

Fallout in the southern hemisphere, and its origins in the national programs of atmospheric nuclear weapons testing in both hemispheres, are reviewed. Of the 390 nuclear tests conducted in the atmosphere to date, 53 were carried out in the southern hemisphere and it is the second phase of these, between 1966 and 1974, that is seen to have been responsible for the main fallout of short-lived fission products in the southern hemisphere. In contrast to this, the programs of atmospheric nuclear testing in the northern hemisphere up to 1962 are shown to have been the main source of long-lived fission products in fallout in the southern hemisphere. The course followed by this contamination through the environment of the southern hemisphere is traced for the national programs of nuclear testing after 1962 taken separately (France, China) and for the earlier national programs taken together (USSR, USA, and UK). The impact on populations in the southern hemisphere of fallout from atmospheric nuclear weapons tests to date is assessed.

998 **Energy sources: Australia's needs. Proceedings of the Australian Institute of Energy first National Conference, held in Newcastle on February 5-9, 1979.** Namisnyk, M. (ed.). Newcastle, Australia; Australian Institute of Energy (1979). vp. (CONF-790247—(Vol.1)).

From 1. national conference of the Australian Institute of Energy; Newcastle, Australia (5 Feb 1979).

Selected papers were processed for inclusion in the data base.

## 5005 Site Resource And Use Studies

999 **Air-quality impacts from Western Surface-coal-mining operations.** Biggs, W.G. Pittsburgh, PA; Air Pollution Control Association (1980). 13p. (CONF-800608—12).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

The Northern Great Plains region of the United States holds vast reserves of coal as well as other energy resources. This study

was performed to determine the impact of a surface mine which was being proposed by Mobil. This mine, called the Rojo Caballos Mine, would be located about in the middle of a sequence of five other mines that had already received permits in the area. In preparing the emissions inventory, two scenarios were developed. One for the year 1988, when the Rojo Caballos operations were assumed to be at the maximum expected coal production rate and for the year 1984, which was a comparison with other modeling efforts that the state had done. The results of these analyses are presented in this paper. The emissions scenarios for both 1984 and 1988 were input into the CDM model along with the meteorological data. The combined production at the time of the calculations was projected to be 89.5 million tons per year of coal. The results indicate that by incorporating the best available control technology and the control of emissions from these facilities, it is possible to operate large surface coal mines in the arid west and stay in compliance with all national and state ambient air quality standards.

### 5006 Regulations

1000 **Bubble concept: an examination of two applications in the utility industry.** Cantrell, W.N. (Tampa Electric Co., FL). pp 5.1-5.14 of Characterization and control of utility emissions. Pittsburgh, PA; Air Pollution Control Association (1980).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

Economic advantages of using the flexible air pollution control alternative of considering all ammonia site plants as a unit are discussed. US regulatory policy now encourages innovative control methods as long as the total emissions do not exceed the sum of current limits on the facility (PSB)

## 51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

### 5101 Basic Studies

*REFER ALSO TO CITATION(S) 1022*

1001 **Measurement of radioactivity in Mount St. Helens volcanic ash by x/sub gamma/ ray spectrometry.** Strauss, M.G.; Sherman, I.S.; Pehl, R.H. (Argonne National Lab, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 244-248(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

A report is presented on the measurements of /sup 238/U and /sup 232/Th activity in ash relative to that in soil. The ash sample is from the May 18, 1980 eruption and the soil sample was obtained in 1978, from the vicinity of the volcano. With the array the analysis of the ash sample, which had an activity of only 0.4 that in soil, will be made in less than 1000 min. This system is a practical instrument for assaying environmental samples having a fraction of the natural activity in soil, where the activity of one or more nuclides cannot be measured readily by /gamma/-ray spectrometry. 4 refs.

1002 **Denitrification as affected by irrigation frequency and applied herbicides.** Rolston, D.E. (California Univ., Davis (USA)); Cervelli, S. (Laboratorio per la Chimica del Torreno - CNR, Pisa, Italy). pp 189-199 of Agrochemical residue-biota interactions in soil and aquatic ecosystems. Proceedings and report of a combined advisory group meeting and research co-ordination meeting on agrochemical residue-biota interactions in soil and water organized by the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture and held in Vienna, 28 August - 2 September 1978. Vienna, Austria; IAEA (1980).

From Combined advisory group meeting and research co-ordination meeting on agrochemical residue-biota interactions in soil and water; Vienna, Austria (28 Aug 1978).

Denitrification from a Yolo loam field profile was studied in relation to the frequency of irrigation water application. Field plots ($1\ m^2$) cropped with grass were intensely instrumented with soil atmosphere samplers, soil solution samplers, tensiometers and neutron access tubes. Equal irrigations of 1.15 of evapotranspiration were applied by a spray irrigation system at three frequencies consisting of three irrigations weekly, one irrigation weekly and one irrigation every two weeks. Fertilizer (300 kg N/ha) was applied uniformly during the first irrigation as $KNO_3$ enriched with 60% $^{15}N$. The flux of the volatile denitrification products at the soil surface was measured from the accumulation of $N_2O$ and $^{15}N_2$ beneath air-tight covers placed over the soil for 2-4-h time periods at frequent intervals after each irrigation. The largest fluxes of $N_2$ and $N_2O$ at the soil surface generally occurred within 3-6 h after the end of irrigation. Fluxes decreased rapidly to near zero values within one to three days after the end of irrigation. As rates and total denitrification were very small for this soil with limiting carbon, differences in denitrification for the three irrigation frequencies were slight. In vitro experiments were carried out as follows: Several herbicides at concentrations of approximately 25 ppm were incubated with glucose (C/N=1.0) and $NO_3^-$ in Yolo soil under He atmospheres at 25°C. Chlorbromuron, atrazine, neburon, linuron and diuron all inhibited $NO_3^-$ reduction with inhibition percentages ranging from 27 to 46%.

1003 **Injected gamma-tracer method for soil-moisture movement investigations in arid zones.** Nair, A.R.; Navada, S.V.; Rao, S.M. (Bhabha Atomic Research Centre, Bombay (India). Isotope Div.). pp 85-92 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

A method for the in-situ determination of soil-moisture transport rates using $K_3{}^{60}Co(CN)_6$ is discussed. The tracer compares well with tritiated water in laboratory investigations and the results obtained in limited field studies are very encouraging. The method promises to be of specific interest in arid-zone investigations where the soil-moisture fluxes in liquid and vapor phases could cause complications for tritium tracer data interpretation.

### 5102 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 1273*

1004 **Effects of combined pesticides application on their persistence in flooded rice soils.** Sethunathan, N.; Sudhakar, B.; Venkateswarlu, K. (Central Rice Research Inst., Cuttack (India)) (and others). pp 259-281 of Agrochemical residue-biota interactions in soil and aquatic ecosystems. Proceedings and report of a combined advisory group meeting and research co-ordination meeting on agrochemical residue-biota interactions in soil and water organized by the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture and held in Vienna, 28 August - 2 September 1978. Vienna, Austria; IAEA (1980).

From Combined advisory group meeting and research co-ordination meeting on agrochemical residue-biota interactions in soil and water; Vienna, Austria (28 Aug 1978).

Pesticide-microflora interactions were studied with special reference to flooded soils. The principal metabolic pathway for the insecticide parathion shifted from nitro group reduction to hydrolysis upon the repeated additions of parathion or its hydrolysis product, p-nitrophenol, to a flooded soil. Both nitro group reduction and hydrolysis are cometabolic reactions; the tremendous build-up of parathion-hydrolysing micro-organisms after parathion additions actually occurred at the expense of the product of the primary cometabolic hydrolysis, p-nitrophenol. The fungicide benomyl significantly increased the persistence of generally short-lived parathion in flooded soil by inhibiting nitro group reduction and hydrolysis. Benomyl inhibited nitrification, iron reduction and the drop in the redox potential in a flooded soil. Aerobically incubated flooded soil liberated more $^{14}CO_2$ from the $^{14}C$ in p-nitrophenol than anaerobically incubated flooded soil. The lag of about 20 days in the degradation of carbofuran and its high water solubility may raise prob-

lems of carbofuran residues in the run-off waters from carbofuran-treated rice fields, particularly in areas comprised of soils capable of remaining acidic even under flooded conditions. Interestingly, during 40-day flooding, $^{14}CO_2$ evolution from ring-$^{14}$C-carbofuran was virtually negligible whereas 16-27% of carbonyl-$^{14}$C was converted to $^{14}CO_2$. Evidence suggests that redox potential, reducing capacity and certain reduction reactions, assayed for example in terms of nitrate disappeared or reduced iron formed, could be used as simple and suitable indicators of the pesticide-degrading capacity of anaerobic systems. Dehydrogenase activity is well pronounced in predominantly anaerobic flooded soil and may have the obvious advantage over the $^{14}CO_2$ evolution technique as an assay for the pesticide-degrading capacity of anaerobic systems.

1005 **Sulfur gas emissions from stored flue gas desulfurization sludges.** Adams, D.F.; Farwell, S.O. (Univ. of Idaho, Moscow). pp 2.1-2.22 of Characterization and control of utility emissions. Pittsburgh, PA; Air Pollution Control Association (1980).

From Air Pollution Control Association annual meeting; Montreal, Canada (Jun 1980).

The emissions of volatile sulfur-containing compounds from 13 flue gas desulfurization (FGD) sludge, field storage sites have been characterized. Sulfur gas emissions from the sludge surfaces were determined by measuring the sulfur gas enhancement of sulfur-free sweep air passing through a dynamic emission flux chamber placed over selected sampling sites. Samples of the enclosure sweep air were cryogenically concentrated in surface-deactivated Pyrex U traps. Analyses were conducted by wall-coated, open-tabular, capillary column, cryogenic gas chromatography using a sulfur-selective, flame photometric detector. Several major variables associated with FGD sludge production processes were examined in relation to the measured range and variations in sulfur flexes including: (a) the sulfur dioxide scrubbing reagent used, (b) sludge sulfite oxidation, (c) unfixed or fixed FGD sludge, (d) ponding or landfill storage. The composition and concentration of the measured sulfur gas emissions were found to vary with the type of sludge, the effectiveness of rainwater drainage from the landfill surface, the method of impoundment, and the sulfate/sulfite ratio of the sludge. Hydrogen sulfide, carbonyl sulfide, dimethyl sulfide, carbon disulfide, and dimethyl disulfide were identified in varying concentrations and ratios in the FGD sludge emissions. In addition, up to four unidentified organo-sulfur compounds were found in the emissions from four FGD sludges. The sulfur flux from one FGD storage pond was analyzed by gas chromatography-single ion monitoring mass spectrometry. In addition to the four identified sulfur compounds, this flux contained large concentrations of benzene, toluene, and α-pinene. The measured, total sulfur emissions ranged from less than 0.01 to nearly 0.3 kg of sulfur per day for an equivalent 100 acre (40.5 hectare) sludge impoundment surface.

### 5103 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 214, 227, 228, 989, 990, 996, 1189*

1006 (IAEA-TECDOC—229, pp 175-183) **Radioecology of uranium and radium with special reference to a uranium mining area.** Stegnar, P. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

Data are presented on the distribution of uranium and Ra-226 radioactivity contents in surface waters, river and stream sediments in the uranium mining area at Zirovski vrh and in some other regions downstream the river Sava. The uranium and radium contents and proportions were also studied in aquatic biota.

1007 **Remote sensing of soil radionuclide fluxes in a tropical ecosystem.** Clegg, B.; Koranda, J.; Robinson, W.; Holladay, G. (Lawrence Livermore Lab., CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 249-254(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

Use is being made of a transponding geostationary satellite to collect surface environmental data to describe the fate of soil-borne radionuclides. The remote, former atomic testing grounds at the Enewetak and Bikini Atolls present a difficult environment in which to collect continuous field data. The land-based, solar-powered microprocessor and environmental data systems remotely acquire measurements of net and total solar radiation, rain, humidity, temperature, and soil-water potentials. A water flux model predicts wet season plant transpiration rates nearly equal to the 6-7 mm/d evaporation pan rate, which decreases to 2-3 mm/d for the dry season. Radioisotopic analysis confirms the microclimate-estimated 1:3 to 1:20 soil to plant /sup 137/Cs dry matter concentration ratio. 14 refs.

1008 **Precipitation of radiostrontium in soil.** Spalding, B.P. (Oak Ridge National Lab., TN). pp 243-250 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Penum Press (1981). Contract W-7405-ENG-26.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The purpose of this study was to learn whether precipitated Ca-Sr phases can be formed in soil when the adsorptive characteristics of soil was amended with the additions of sodium solutions of hydroxide, fluoride, carbonate, oxalate, phosphate, aluminate and silicate. Candidate insoluble Ca-Sr phases include the carbonate, oxalate, fluoride, phosphate, aluminate, and silicate. More important than the formation of these phases in soil is the knowledge of how isotopically/isomorphically exchangeable any precipitated activity would be with dissolved Ca in a leaching groundwater. These questions were addressed experimentally by treating soils with a fixed quantity of the particular precipitating anion solution and, subsequently, spiking this mixture with an increment of $CaCl_2$ containing either $^{45}$Ca, $^{85}$Sr, or $^{22}$Na and observing the radioisotopic distribution. Two additional increments of $CaCl_2$ were sequentially added and the redistributions of radioisotopes observed. Such a batch equilibrium method was designed to simulate a chemically-modifed soil coming into contact with a radiostrontium contaminated groundwater and the subsequent leaching of any nascent precipitated phase by additional groundwater. The choice of precipitating anions were found to carbonate and phosphate. Although preliminary column leaching experiments indicated that carbonate is slightly more effective than phosphate in immobilizing radiostrontium, both chemicals have potential.

## 52 ENVIRONMENTAL SCIENCES, AQUATIC

### 5201 Basic Studies

*REFER ALSO TO CITATION(S) 1034, 1114*

1009 **Environmental isotope balance of Lake Kinneret as a tool in evaporation rate estimation.** Lewis, S. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotopes). pp 33-55 of Isotopes in lake studies. Proceedings of an advisory group meeting on the application of nuclear techniques to the study of lake dynamics organized by the IAEA and held in Vienna from 29 August to 2 September 1977. Vienna, Austria; IAEA (1979).

From Advisory group meeting on the application of nuclear techniques to the study of lake dynamics; Vienna, Austria (29 Aug 1977).

The balance of environmental isotopes in Lake Kinneret has been used to obtain an independent estimate of the mean monthly evaporation rate. Direct calculation was precluded by the inadequacy of the isotope data in uniquely representing the system behaviour throughout the annual cycle. The approach adopted uses an automatic algorithm to seek an objective best fit of the isotope balance model to measured oxygen-18 data by optimizing the evaporation rate as a parameter. To this end, evaporation is described as a periodic function with two parameters. The sensitivity of the evaporation rate estimates to parameter uncertainty and data errors is

stressed. Error analysis puts confidence limits on the estimates obtained. Projected improvements in data collection and analysis show that a significant reduction in uncertainty can be realized. Relative to energy balance estimates, currently obtainable data result in about 30% uncertainty. The most optimistic scenario would yield about 15% relative uncertainty.

1010 **Isotope studies of nitrogen transformations in Castle Lake, California.** Gersberg, R.M.; Axler, R.P.; Goldman, C.R. (California Univ., Davis (USA)). pp 75-85 of Agrochemical residue-biota interactions in soil and aquatic ecosystems. Proceedings and report of a combined advisory group meeting and research co-ordination meeting on agrochemical residue-biota interactions in soil and water organized by the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture and held in Vienna, 28 August - 2 September 1978. Vienna, Austria; IAEA (1980).

From Combined advisory group meeting and research co-ordination meeting on agrochemical residue-biota interactions in soil and water; Vienna, Austria (28 Aug 1978).

The use of the $^{14}C$ and $^{15}N$ tracer techniques in the past two decades has greatly increased the understanding of the role of inorganic nitrogen with regard to aquatic primary productivity. Both of these techniques have been used at Castle Lake, California, and the studies have been extended to include the $^{13}N$ radiotracer method. Nitrogen-13-labelled nitrate was used to measure the short-term uptake rates of phytoplankton and they compare well with longer term $^{15}N$ data. The $^{13}N$ technique can also provide a sensitive assay for denitrification in natural systems without significant nitrate amendment. These nitrogen uptake studies show that the rate of ammonium uptake far exceeds that of nitrate. Ammonium enhances $^{14}C$ fixation in the light and in the dark, suggesting algal populations are at certain times, under natural conditions, deficient in nitrogen. Simple analyses of external nitrogen loading rates are often inadequate for predicting levels of aquatic productivity since the two forms of dissolved inorganic nitrogen internally cycle at rather different rates, and denitrification can account for a significant loss of combined nitrogen.

1011 **Precipitation, flood- and groundwaters of the Negev Highlands. An isotopic study of desert hydrology.** Levin, M.; Issar, A. (Inst. for Desert Research, Ben-Gurion Univ. of the Negev, Sdeh-Boger, Israel). pp 3-22 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Precipitation in the Negev highlands was found to be surprisingly depleted of $^{18}O$ and deuterium and generally characterized by deuterium excess values of $d > 15$/mille. Isotopic compositions are relatively uniform over a wide area on any particular day, but differ appreciably from storm to storm. Thus, they are valuable tools for hydrographic analysis of flood-flows. Flood-flow samples, collected in Nahal-Zin and Nahal-Besor, were often even more depleted in heavy isotopes than the total rainstorm, indicating that run-off is generated selectively by high-intensity rains. The initial rush of the flood flushed away the surface salinity and saline accumulations in surface pools, but apparently does not involve sub-surface salinity to any great extent. Recharge to groundwater appears to be accompanied by a slight evaporative enrichment of the isotopes, more so in the case of waters recharged from flood-flows. Environmental tritium can be used as an indicator of direct floodwater contributions to the aquifers.

1012 **Use of environmental isotopes in arid zone hydrology.** Dincer, T. pp 23-30 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

After aridity is defined some physical and hydrologic features common in arid lands are described. An attempt has been made to identify various groundwater recharge mechanisms in arid countries and to assess their relative importance. The influence of the arid climates on the isotopic composition of the precipitation is discussed. The use of environmental isotopes in run-off and precipitation infiltration and recharge is evaluated, and the importance of isotopic studies in investigating interrelations between aquifers is stressed. Finally, some examples of isotope applications in surface water and its relation to groundwater are given.

1013 **Interpretation of environmental isotopic groundwater data. Arid and semi-arid zones.** Geyh, M.A. (Niedersaechsisches Landesamt fuer Bodenforschung, Hannover (Germany, F.R.)). pp 31-46 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Various hydrodynamic aspects are discussed in order to show their implication for the hydrogeological interpretation of environmental isotope and hydrochemical groundwater data. Special attention is drawn to radiocarbon and tritium studies carried out in arid and semi-arid zones. An exponential model has been utilized to determine the mean residence time of the long-term water from springs in karst and crystalline regions. Hydrogeological parameters such as the porosity can be checked by this result. In addition, the exponential model offers the possibility of determining the initial $^{14}C$ content of spring water, which is sensitively dependent on the soil of the recharge area. A base-flow model has been introduced to interpret the $^{14}C$ and $^{3}H$ data of groundwater samples from older karst regions. Differences between pumped and drawn samples exist with respect to the groundwater budget. Owing to pumping, the old base flow is accelerated and becomes enriched in pumped groundwater in comparison to the short-term water. Radiocarbon ages of groundwater in alluvium may be dubious because of isotope exchange with the $CO_2$ in the root zone along the river bank. Under confined conditions $^{14}C$ groundwater ages are diminished if the hydraulic head of the confined aquifer is lower than that of the shallow one. This is due to the radiocarbon downwards transport by convection of shallow groundwater. The same effect occurs, though much faster, if the groundwater table is depleted by groundwater withdrawal. The decrease of the radiocarbon groundwater ages in time can be used to determine the hydraulic transmissibility coefficient of the aquitarde. According to the practical and theoretic results obtained the hydrodynamic aspects require at least the same attention for the interpretation of environmental isotope and hydrochemical data of groundwater as do hydrochemical and isotope fractionation processes.

1014 **Geochemical and isotopic approach to recharge evaluation in semi-arid zones: past and present.** Edmunds, W.M.; Walton, N.R.G. (Institute of Geological Sciences, Wallingford, Oxfordshire, UK). pp 47-68 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

The magnitude of any recharge to aquifers in semi-arid and arid zones is the principal uncertainty in estimating a water balance. Recent studies in Cyprus and Libyan Arab Jamahiriya are currently being used to demonstrate the application of geochemical and isotopic techniques, to the determination of both current and palaeo-recharge. In Cyprus, solute profiles of the unsaturated zone have been interpreted to provide estimates of the direct recharge component using a steady-state, mass-balance approach; results from the chloride profiles compare well with recharge estimates using tritium. In addition, it is found that some solute peaks, notably for specific electrical conductance, give a reasonably accurate record of the rainfall history during the period 1950-1975. The solute profile method is relatively unsophisticated and could be more widely

applied to recharge estimation in other semi-arid areas of the world. In Libya, a clear distinction can be made using the combined isotopic, hydrological and geochemical results between regional groundwaters recharged to the upper, unconfined aquifer of the Sirte Basin before 13,000 years BP and younger waters recharged locally during the period 5000 to 7800 years BP. A well-defined fresh-water channel, superimposed upon the regional water quality pattern, can be traced within the aquifer for some 130 km and represents direct evidence of recharge during the Holocene. Some shallow groundwaters of similar composition to the fresh-water channel are also considered to represent recent, if intermittent, recharge which took place during historical times. It is concluded that geochemical and isotopic studies of both the unsaturated zone and of shallow groundwaters in semi-arid regions, can be used to determine not only the present-day direct recharge component, but also a recharge chronology of immediate historic times, which may be important in the estimation of long-term water resources.

1015 **Examination of recharge mound decay and fossil gradients in arid regional sedimentary basins.** Lloyd, J.W. (Birmingham Univ. (UK)). pp 69-75 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

In many of the vast arid sedimentary basins of the world, groundwater gradients exist that appear to be anomalous in the context of the probable modern recharge potential. The possibility that such gradients are in fact remnant fossil conditions representing the decay of ancient recharge mounds is examined. An example of decay condition is represented using a resistor-network analogue model in which the time control is based on $^{14}C$ ages. The decay hypothesis is found to be plausible with realistic aquifer characteristics but a non-homogeneous flow is indicated from the $^{14}C$ data.

1016 **Environmental isotopes in North African groundwaters; and the Dahna sand-dune study, Saudi Arabia.** Sonntag, C.; Thoma, G.; Muennich, K.O. (Heidelberg Univ. (Germany, F.R.)); Dincer, T. (Food and Agriculture Organization of the United Nations, Rome (Italy)); Klitzsch, E. (Technische Univ. Berlin (Germany, F.R.)). pp 77-84 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

(I) North Saharian palaeowaters were mainly formed during a long humid period between 50,000 and 20,000 years BP, which was followed by a cool dry period from 20,000 to 14,000 years BP. These palaeowaters show a significant west-east decrease in deuterium and $^{18}O$ because of past groundwater formation by local rainfall from the western drift. Sahel zone groundwaters seem to show meridional variation of deuterium and $^{18}O$ due to a tropical convective influence. (II) A computer model estimate of the alternate play between rainwater infiltration and evaporation in the Dahna sand-dune (near Riyadh, Saudi Arabia) yields a mean annual groundwater recharge of 20 mm annually which agrees with that obtained from bomb tritium vertical profiles of the sand moisture. The model also describes the deuterium and $^{18}O$ profiles.

1017 **Aspects of the isotope hydrology of two sandstone aquifers in arid Australia.** Airey, P.L.; Calf, G.E.; Hartley, P.E.; Roman, D. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Isotope Div.). pp 93-111 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Much of Australia's arid zone lies in a high-temperature region where potential evaporation rates can exceed the mean annual rainfall by more than an order of magnitude. Underground water therefore tends to be a biased sample of precipitation. The effect of this biasing on the stable isotopic composition and the deuterium excess of water from the Mereenie Sandstone aquifer and the western extremities of the Great Artesian Basin is discussed. An explanation is offered for an observed systematic decrease in the standard deviation of stable isotope ratios with increasing residence time. An analytical solution of a simplified version of the groundwater transport equation is presented which allows a clear mathematical distinction to be made between a flowing and a non-flowing aquifer system. This distinction can be useful in arid zones where the isotopic data may not be inherently predictable from the modern conditions at input because of substantial differences in recharge rates over the accessible time scales. The mathematical expressions also provide a basis for assessing when $^{14}C$ data are more logically presented as absolute activities than as the conventional $^{14}C$ (per cent modern carbon) ratios.

1018 **Study of the leakage between two aquifers in Hermosillo, Mexico, using environmental isotopes.** Payne, B.R.; Quijano, L. (International Atomic Energy Agency, Vienna (Austria)); Latorre, D.C. (Grupo de Fisica, Secretaria de Agricultura y Recursos Hidraulicos, Mexico). pp 113-130 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

The Coast of Hermosillo is located in the Gulf of California, Mexico. It is a Quaternary alluvial plain of continental origin. Underlying these deposits is a layer of blue clay about 100m thick which imposes confinement to a deep aquifer in basaltic and pyroclastic rocks. Oxygen-18 and deuterium data support the occurrence of an upwardleakage. The amount of the leakage was evaluated, on the basis of $^{14}C$ data, to a maximum of 20% of the water pumped by the irrigation wells in the upper aquifer. The stable isotope data also support the occurrence of sea-water intrusion by preferential channels in the south and in the area of Kino Bay.

1019 **Utilization of natural isotopes in the study of salination of the waters in the Pajeu River Valley, northeast Brazil.** Salati, E.; Matsui, E. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil)); Leal, J.M. (Superintendencia do Desenvolvimento do Nordeste, Recife, Brazil); Fritz, P. (Waterloo Univ., Ontario (Canada)). pp 133-151 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Municipal and agricultural water supplies in the vast regions on the Brazilian Shield come primarily from shallow groundwater systems in weathered bedrock and minor amounts of alluvial fill. The water quality is generally poor. This salination of water supplies is a serious problem because no management schemes have been proposed to solve water shortages and to improve water quality. In this study it is shown that salination is an active process which is not related to the release of fossil sea-water trapped in the crystalline rocks since Cretaceous times, nor is it related to intensive weathering of the bedrock. Evaporation and evapotranspiration must account for it with the salt being brought primarily by precipitations. It is suggested that increased pumping of these shallow aquifers during the dry season will not result in a general improvement of water quality, thus limiting the potential of these aquifers to their present usage.

**1020 Isotope investigations as a tool for regional hydrogeological studies in the Libyan Arab Jamahiriya.** Srdoc, D.; Sliepcevic, A.; Obelic, B.; Horvatincic, N. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Moser, H.; Stichler, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie). pp 153-164 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

$^{14}C$-, $^{3}H$, and stable isotope analyses were done on Libyan waters from wells in the Wadi Sawfajjin-Wadi Zamzam-Al Jufrah area during a complex hydrogeological survey. Water from different aquifers can be differentiated by their isotope content. The results generally show $^{14}C$ ages older than 12,000 years with increasing groundwater age going toward the east and southeast. The hydrogeological concept of a continuous flow from the Palaeozoic aquifer through the Chicla aquifer toward the Mediterranean Sea is confirmed by the $^{14}C$ measurements. This means that the Socna aquifer is recharged from the Palaeozoic aquifer, and the Eocene aquifer from the Chicla aquifer. The stable isotope content sorts the waters of the investigated aquifers into two groups. The relatively high $^{2}H$- and $^{18}O$-contents of the Upper Cretaceous aquifers and the Chicla aquifer indicate a possible recharge during pluvial times from Jebel Nefusa. Low $^{2}H$- and $^{18}O$-contents of the Palaeozoic, Chicla, Eocene and, in particular, the Socna aquifer, confirm the recharge of the Socna aquifer from deeper aquifers and show that the Palaeozoic and Chicla aquifers belong to an interconnected underground system.

**1021 Groundwater flow patterns in the western Libyan Arab Jamahiriya evaluated from isotopic data.** Salem, O. (Secretariat of Dams and Water Resources, Tripoli, Libyan Arab Jamahiriya); Visser, J.H. (United Nations Food and Agriculture Organization, Land and Water Investigation Project, Tripoli, Libyan Arab Jamahiriya); Dray, M.; Gonfiantini, R. (International Atomic Energy Agency, Vienna (Austria)). pp 165-179 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Stable isotope analyses were used to provide evidence of the main features of regional groundwater flow patterns and to show interconnections between aquifers in the western Libyan Arab Jamahiriya. The main flow is from south to north in the Palaeozoic aquifer, but a component deriving from a recharge area in the west is present in the Wadi Ash Shati Valley and increases significantly to the north of Jebel Gargaf. This groundwater, which originated in the west, is also the major recharge source of the important Kicla aquifer which in turn recharges the overlying Upper Cretaceous formations in the area of Misratah. More to the north, the Kicla aquifer is also recharged by precipitation over the Jebel Nefusa. In the north, the Tawurgha spring is fed mainly by the Miocene aquifer and not by the Upper Cretaceous ones.

**1022 Recharge of groundwaters in arid areas. Case of the Djeffara plain in Tripolitania, Libyan Arab Jamahiriya.** Allemmoz, M. (Groupement d'Etudes et de Realisations des Societes d'Amenagement Regional, Nimes, France); Olive, P. (Centre de Recherches Geodynamiques, Thonon-les-Bains, France). pp 181-191 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

By means of soil water contents and variations of piezometric levels and tritium concentration, the recharge of groundwaters is determined. If direct infiltration of precipitation is negligible, the major recharge mechanism is the infiltration through the wadi beds during floods.

**1023 Aspects of the environmental isotope chemistry in groundwaters in Eastern Jordan.** Lloyd, J.W. (Birmingham Univ. (UK)). pp 193-204 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Aspects of the environmental isotope data from a sandstone and a limestone aquifer are given. The data concerning the sandstone are limited but indicate the type of recharge that is occurring in the outcrop area. Although the $^{14}C$ data indicate some modern recharge in radiocarbon terms the tritium data show evidence of only localized recharge. Stable isotope data from one well indicate that indirect recharge may be important. In the limestone aquifer it is found that tritiated groundwater occurs chiefly in the vicinity of wadis indicating the importance of indirect recharge. The lack of tritiated groundwater in the recharge mounds in the interfluve areas is seen as partly a function of sampling but also as indicating the high permeability zones at the tops of the aquifers. The $\delta^{13}C$ data distribution are examined with respect to possible recharge mechanisms.

**1024 Conceptual hydrochemical model for alluvial aquifers on the Saudi Arabian basement shield.** Lloyd, J.W. (Birmingham Univ. (UK)); Fritz, P. (Waterloo Univ., Ontario (Canada). Dept. of Earth Sciences); Charlesworth, D. (MacLaren (James F.) Ltd., Willowdale, Ontario (Canada)). pp 205-213 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Situated across the Precambrian Basement shield of Saudi Arabia is a sequence of alluvial-filled wadis which contain the main groundwater resources of the area. The groundwater in some of the wadis indicates a central wadi fresh groundwater zone with highly saline groundwater occurring at the edges of the major alluvial thicknesses. The distribution of the chemistry in the groundwaters is examined and a conceptual model is given for one main wadi. Both the major ion chemistry and the environmental isotopes are used to demonstrate that the edge effect high salinity is the result of evaporative action and the concentration of salts in groundwater entering the main wadi from side wadis containing thin alluvial fill deposits.

**1025 Isotope methods as a tool for Quaternary studies in Saudi Arabia.** Hoetzl, H. (Karlsruhe Univ. (TH) (Germany, F.R.)); Job, C. (Innsbruck Univ. (Austria)); Moser, H.; Rauert, W.; Stichler, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie); Zoetl, J.G. (Technische Univ., Graz (Austria)). pp 215-235 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Within the framework of a combined sedimentological, hydrogeological, hydrochemical, geomorphical and climatological investigation in central and eastern Saudi Arabia various environmental isotope studies were performed. $^{14}C$ measurements on shells from different shell banks in the Gulf coastal region confirmed the existence of sea-level fluctuations during the Wuerm time and during the Holocene. Measurements of $^{2}H$, $^{18}O$, and $^{3}H$ contents

of water samples from the Al Qatif and Al Hasa areas gave valuable information on the origin and the fate of these waters as well as on hydraulic connections between aquifer strata. $^{14}C$ measurements on calcite crusts in the region As Sulb Plateau confirm that the precipitation of the Neolithic Pluvial reactivated the karst development in this region. In its southwestern part, different $^{14}C$ values of stalactites and of duricrust cementing the stalactites show the development of duricrust during late Pleistocene and/or Holocene. In the upper part of Wadi Ar Rimah, a close insight into the causes of salination of groundwaters was obtained by studying their contents of $^{2}H$, $^{18}O$, and $^{3}H$ in combination with hydrochemical data. It is shown that secondary and tertiary evaporation during irrigation and infiltration must be taken into consideration. In Wadi Ad Dawasir and its hinterland the $^{2}H$ and $^{18}O$ enrichment and that of the mineralization in hand-dug wells were explained by an admixture of recent shallow groundwater with old sandstone water.

1026 **Environmental isotope study of groundwater systems in the Republic of Djibouti.** Fontes, J.C.; Saliege, J.F.; Zuppi, G.M. (Paris-6 Univ., 75 (France). Lab. de Geologie Dynamique); Pouchan, P. (Laboratoire de Geodynamique, Universite de Bordeaux 3, Talence, France). pp 237-262 of Arid zone hydrology. Investigations with isotope techniques. Proceedings of an advisory group meeting on application of isotope techniques in arid zones hydrology organized by the IAEA and held in Vienna from 6 to 9 November 1978. Vienna, Austria; IAEA (1980).

From Advisory group meeting on application of isotope techniques in arid zones hydrology; Vienna, Austria (6 Nov 1978).

Environmental isotopes and hydrogeochemistry are being used to shed new light on the occurrence of present-day recharge and on the origin of groundwater systems in the Republic of Djibouti. Furthermore, an attempt is also being made to evaluate palaeohydrological conditions during the past 6000 years. From stable isotope data which lie along a correlation line at a slope of 8 in the diagram $\delta^{2}H$-$\delta^{18}O$, it can be concluded that recharge occurs by rapid seepage in fractured rocks without evaporation. Some waters from hot springs show an oxygen shift, indicating the occurrence of an exchange process with rocks at high temperatures. The following conclusions can be reached from tritium and $^{14}C$ content of waters. Groundwaters can be divided into two groups: one deriving from recent recharge (last five or six years) corresponding to water with rather fast circulations in fractured media; and a second group, pre-bomb recharged corresponding to water with low flow rates in porous media. Only one sample (Yoboki) seems to derive from about 10-year-old recharge. In the case of Abhe hot spring, a $^{14}C$ age of about 1200 years may be evaluated. The calcite concretions of the Abhe Lake Basin are believed to have formed as a result of the mixing of lake water (sodium-carbonate type) with groundwater (sodium-chloride, calcium-sulfate type). From the $^{13}C$ and $^{14}C$ content it appears that the dissolved carbon of present-day lake water is in, or close to, equilibrium with the atmosphere. Consequently, it is assumed that such was also the case during the whole Holocene. The $^{18}O$ content of palaeolake water, evaluated from the calcite isotopic composition with the palaeo-temperature equation, was originally more negative than the present one. This is interpreted as due to the fact that the Holocene lake was fed by large floods and that significant seepage occurred through the lake bottom with a consequent reduction of the evaporation effects.

1027 **Determination by stable isotopes of underground inflow and outflow and evaporation of young artificial groundwater lakes.** Zimmermann, U. (Heidelberg Univ. (Germany, F.R.)). pp 87-94 of Isotopes in lake studies. Proceedings of an advisory group meeting on the application of nuclear techniques to the study of lake dynamics organized by the IAEA and held in Vienna from 29 August to 2 September 1977. Vienna, Austria; IAEA (1979).

From Advisory group meeting on the application of nuclear techniques to the study of lake dynamics; Vienna, Austria (29 Aug 1977).

The evaporation rate as well as the subsurface inflow and outflow rate of two young artificial groundwater lakes, which did not reach their isotope steady state during the period of investigation, could be determined by using stable isotopes. The main results of the research performed, which are also important for stable isotope studies of natural lakes, can be summarized as follows: (a) deuterium is better suited to determine a component of the water balance of a lake than $^{18}O$, because the same error of the kinetic separation induces a much larger error in the case of $^{18}O$ than in the case of D; (b) stable isotopes are above all suited to determine the inflow and outflow rate of a lake; (c) large errors can arise if the surface lake water temperature, which has to be known for the calculation of the normalized humidity, is not measured directly; (d) as the evaporation rate cannot be determined with an accuracy better than 30% by using stable isotopes in most cases, other methods should be preferred for determining the evaporation rate of a lake.

1028 **Whole lake tritium spikes to measure horizontal and vertical mixing rates.** Quay, P.D. (Washington Univ., Seattle (USA). Quaternary Research Center); Broecker, W.S. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory); Hesslein, R.H.; Fee, E.J.; Schindler, D.W. (Freshwater Inst., Department of Environment, Winnipeg, Manitoba, Canada). pp 175-193 of Isotopes in lake studies. Proceedings of an advisory group meeting on the application of nuclear techniques to the study of lake dynamics organized by the IAEA and held in Vienna from 29 August to 2 September 1977. Vienna, Austria; IAEA (1979).

From Advisory group meeting on the application of nuclear techniques to the study of lake dynamics; Vienna, Austria (29 Aug 1977).

Tritiated water was repeatedly injected into two small lakes (L224 and L227) in order to determine vertical and horizontal mixing rates. The vertical diffusion rate is extremely slow in the highly stratified thermocline region, where the values of $7x10^{-5}$ $cm^{2}.s^{-1}$ and $5x10^{-4}$ $cm^{2}.s^{-1}$ were measured in L227 and in L224 respectively. These values are signficantly lower than the molecular diffusion rate of heat. Vertical diffusion rates are about 30 times higher in the hypolimnion, indicating that they increase with depth during summer stratification. Horizontal eddy diffusion rates are much higher in the epilimnion than in the thermocline and in the hypolimnion. For instance, in L227 the epilimnion became homogeneous one day after tracer injection (diffusion rate 1350 $cm^{2}.s^{-1}$). In the thermocline the horizontal diffusion rate was 75 times lower (18 $cm^{2}.s^{-1}$), almost the same as in the hypolimnion (16 $cm^{2}.s^{-1}$). In L224 the horizontal diffusion rate is significantly lower in the hypolimnion than in the thermocline. This suggests that the thermocline acts as a barrier inhibiting the downward transfer of turbulent mixing energy.

1029 **Natural radon as a limnological tracer for the study of vertical and horizontal eddy diffusion.** Imboden, D.M. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). pp 213-218 of Isotopes in lake studies. Proceedings of an advisory group meeting on the application of nuclear techniques to the study of lake dynamics organized by the IAEA and held in Vienna from 29 August to 2 September 1977. Vienna, Austria; IAEA (1979).

From Advisory group meeting on the application of nuclear techniques to the study of lake dynamics; Vienna, Austria (29 Aug 1977).

Radon-222 (half-life 3.8 d) has been used successfully as a geochemical tracer for vertical near bottom mixing in the ocean. The parent nuclide radium-226 (half-life 1600 a) occurs in far greater quantities in sediments than in the water column, thus providing a boundary source for emanation of radon. Vertical mixing in lakes may be of central importance for the evolution of chemical and biological processes. Most lakes pass through a stagnation period during which the euphotic zone continuously loses nutrients by sedimentation of plankton through the thermocline. The return flux of nutrients from the sediments through the hypolimnion and thermocline to the euphotic layer can only be understood and quantified if vertical mixing processes are known. The traditional means by which vertical eddy diffusion is calculated is the temperature method. However, temperature changes near the bottom of deep lakes are often too small to be measured. Among various (natural or man-made) geochemical tracers radon-222 seems to be especially suitable for the study of vertical mixing since its 'memory' of about one week very often allows measured activities to be interpreted in terms of a relatively simple steady-state model.

1030 **Tritium and helium-3 studies in Lake Constance.** Weiss, W. (Heidelberg Univ. (Germany, F.R.)). pp 227-231 of Isotopes in lake studies. Proceedings of an advisory group meeting on the application of nuclear techniques to the study of lake dynamics organized by the IAEA and held in Vienna from 29 August to 2 September 1977. Vienna, Austria; IAEA (1979).

From Advisory group meeting on the application of nuclear techniques to the study of lake dynamics; Vienna, Austria (29 Aug 1977).

From the experimental work at present available, a qualitative understanding of the processes of gas exchange with the atmosphere and of internal mixing of the water of large lakes can be derived. A quantitative treatment of these processes and of the parameters governing them still lags behind considerably, because of experimental and methodological difficulties. The dynamic response of a large lake to changes in its environmental conditions is thus far from being predictable. It is evident, on the other hand, that besides biological/chemical processes the physical processes in question play an important role in the budgets of many substances dissolved in the lake water, e.g. $CO_2$, $O_2$ and phosphorus. One approach to a better understanding of these processes is the use of geochemical tracers that are present in natural lakes, e.g. deuterium, oxygen-18, tritium, helium-3 and radon-222. This present communication is a status report of a continuing study being carried out in Lake Constance, Federal Republic of Germany. Bomb tritium and its decay product helium-3 as well as radon-222 have been used in this study. The results of the tritium and the helium-3 will be discussed here.

1031 **Arid zone hydrology. Investigations with isotope techniques.** Vienna, Austria; International Atomic Energy Agency (1978). vp. (CONF-781189—).

From Conference on dense plasmas; Pasadena, CA, USA (14 Nov 1978).

Separate abstracts have been prepared for individual items within scope for inclusion in the Energy Data Base.

1032 (INIS-mf—6422, pp vp) **Radiotracer monitoring of water flow in dams.** Ravinger, R. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia)). [nd]. (In Slovak). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

1033 (INIS-mf—6422, pp vp) **Relations between surface and ground water studied by tritium analyses.** Pospisil, P. (Komenskeho Univ., Bratislava (Czechoslovakia). Prirodovedecka Fakulta). [nd]. (In Slovak). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

## 5202 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 1019, 1024*

1034 **Solute transport in the unsaturated zone of the Chalk.** Oakes, D.B. (Water Research Association, Medmenham (UK)). pp 15-27 of Nuclear techniques in groundwater pollution research. Proceedings of an advisory group meeting organized by the IAEA. Vienna, Austria; IAEA (1980).

From Advisory group meeting on the use of nuclear technology in water pollution studies; Cracow, Poland (6 Dec 1976).

Groundwater is a major source of public supply in England and Wales, where it meets about 30% of the demand. In some areas, particularly south-east England, it is the major source. Much concern has been expressed in recent years about the pollution of groundwater resources by nitrates, and the Water Research Centre has undertaken an extensive programme of drilling and sampling to determine the reason for the rise in nitrate levels and to assess future trends. To assist with the interpretation of field data, mechanisms of water and solute movement through the unsaturated zone have been investigated, and the Chalk, our major aquifer, has received particular attention. The dating of groundwater by tritium measurements has led to considerable speculation regarding flow processes in the Chalk, and the additional information gained from the nitrates investigations has led to the formulation of a flow model in which water and its solutes move at very different velocities. It has been deduced that in the unsaturated zone water moves downwards through the fissure system at about 0.7 m/d, while any solutes carried from the land surface move downwards at about 1 m/a. Laboratory experiments have yielded evidence in support of this hypothesis, though further research is needed before a comprehensive model of the flow mechanism can be established. A similar flow mechanism is expected to be operative in many other aquifers, and has important implications for groundwater pollution trends.

1035 **Groundwater pollution considered as a continuous injection of tracers.** Exler, H.J. (Bayerisches Geologisches Landesamt, Muenchen (Germany, F.R.)). pp 83-101 of Nuclear techniques in groundwater pollution research. Proceedings of an advisory group meeting organized by the IAEA. Vienna, Austria; IAEA (1980).

From Advisory group meeting on the use of nuclear technology in water pollution studies; Cracow, Poland (6 Dec 1976).

The Bavarian Geological Survey has been investigating for more than 10 years the extent and range of groundwater contaminants derived from a domestic and industrial refuse tip. The results of investigations have shown that contaminated groundwater travelled at least 5000 m. The investigation involved a general survey of electrical conductivity and groundwater temperature as well as supporting evidence of pollution by analysis for chloride, permanganate value and nitrate. The sampling points were so placed that some gave slight and variable indications of possible contamination and others none at all. As results showed, the chloride components increased sharply in groundwater passing under the tip. Chloride in the underflow cannot be removed and its concentration is reduced only by dilution. The investigations showed a relationship between electrical conductivity of groundwater and chloride concentration. On this basis, the chloride concentration, as indicated by electrical conductivity, allowed the path of the pollution to be traced throughout the zone in which the organic components and the nitrate were decaying or already decayed. A comparison of the direction of groundwater flow with the distribution of chloride and electrical conductivity shows very good agreement. Increased electrical conductivity could always be followed along a line of observation points. A comparison of electrical conductivity and its variation at different times shows the change of flow direction for a certain period. The investigation established that the direction of groundwater flow and its changes could certainly be traced over a distance of more than 5000 m. The hope of thus being able to follow certain maxima from bore to bore and hence to obtain an indication of the flow velocity, was not fulfilled.

## 5203 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 82, 222, 231, 233, 989, 990, 996, 1190, 1192*

1036 (IAEA-TECDOC—229, pp 41-48) **Methodology used for the study of sorption properties of bottom sediments and some basic information on the behaviour of selected radionuclides in aqueous media.** Mansfeld, A. (Vyzkumny Ustav Vodohospodarsky, Prague (Czechoslovakia)). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

The study gives some basic information on the behaviour of selected radionuclides (Ra-226, uranium, Cr-51, Co-60, Sr-89, I-131 and Cs-137) in aquatic environment. The significance of bottom sediments in investigations of radionuclide sorption and migration, as well as prediction of radionuclide transfer in aquatic environment, are emphasized.

1037 (IAEA-TECDOC—229, pp 55-93) **Radiological analysis of the river system of the upper Danube.** Huebel, K.; Herrmann, H.; Laschka, D.; Luensmann, W.; Ruf, M. (Bayerische Landesanstalt fuer Wasserforschung, Muenchen (Germany, F.R.)). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

The Legislature governing radiation protection in a great many countries stipulates the limited dose for human beings, confining the permissible emission of radioactive waste products into the environment. For this purpose, mathematical models are formulated which permit to establish the corresponding dose from the emission rates of nuclear systems and facilities. In these models, the biological transfer factors are of prime importance. - In observing the various exposure routes involved in waste disposal, it will be seen that a considerable proportion of the resulting dose stems from eating fish and also the exposure to the environment of dried-up river banks. This paper thus presents the accumulation factors for fish and sediments for a few of the elements which mostly occur in nuclear power stations obtained from many years of investigations in the Bavarian Danube area.

1038 (IAEA-TECDOC—229, pp 95-126) **Study on the problems of the radioecology of the river Danube.** Sztanyik, L.B. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

The regular sampling of water, sediment, seston and aquatic biota has been started by the Institute at five sampling sites along the river Danube in Hungary. Methods for sampling, measuring and radiochemical analyses have been developed for the detection of radionuclides in water, sediment and other compartments of the river and these techniques have been applied as routine control methods. The present study includes the results of the analyses of different river samples and gives some basic information about the current radioactivity levels in the Hungarian reach of the Danube. - The radioactivity level is low and is determined primarily by natural radionuclides. Some slight seasonal change is observed. No significant activity difference can be established between the in- and outflowing water. Notwithstanding that the radioactivity value is very low, it is advisable to perform further samplings and measurements and collecting data with respect to the utilization of the Danube water, in order to make assessment of the radiation exposure of the population by radiation originated from the Danube.

1039 (IAEA-TECDOC—229, pp 153-157) **Radioactive contamination of the Soviet part of the mouth of the Danube and the adjacent area of the Black Sea in 1976-78.** Gusev, D.I.; Zesenko, A.Ya.; Pavlovskij, O.A.; Rysik, N.S.; Stepanova, V.D. (Institut Biofiziki, Moscow (USSR)). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

The paper presents data obtained in 1976-78 from radiochemical and gamma-spectrometric analyses of water and hydrobiont samples taken from the Soviet part of the mouth of the Danube and the adjacent area of the Black Sea.

1040 (IAEA-TECDOC—229, pp 159-173) **Determination of biogeochemical and radioecological characteristics of the Vardar River system.** Anovski, T. (Centar za Primena na Radioizotopi vo Stopanstvo, Skoplje (Yugoslavia)). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

In attempt to make an approach in determining the radioecological characteristics of the Vardar river (in the vicinity of Krivolak) on which a nuclear power plant is planning to be constructed, activation analysis and other isotope techniques parallel with some radiological measurements were applied. Using instrumental neutron activation analysis the distribution of Sb, Hg, Fe, Zn, Co, La and Sc in the samples of water, suspended and bed material of the Vardar river as well as in the environmental soil samples of the river's basin, were determined, giving preliminary data about their behaviour and the mechanism of transport along the river, which are analogical to the transport of corresponding radioisotopes. Natural isotope ($\delta^{18}O$ and $\delta D$) distribution in samples from the hydrological cycle of the water was determined with an aim to establish the relation between precipitations, surface and underground waters from the Krivolak area, obtaining in such way parameters about the possible pathways of radionuclides released to the environment. In addition to this, determination of the ambient radioactivity of the Krivolak region has been initiated. Total beta radioactivity was measured in samples of water, soil and food products. Specific activity of K-40 in food products, H-3 in precipitations, surface and underground water, and C-14 in surface and underground water were determined also, to establish the release limits.

1041 (IAEA-TECDOC—229, pp 35-39) **Application of the concept of collective dose commitment in environmental monitoring selection of significant radionuclides.** Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

After considering the possibilities on the calculation of collective dose commitment (CDC) an estimation is presented on the per capita dose resulting from the intake of water from the Danube river. The calculation is based on the data of radioactivity concentrations as determined in 1977 and 1978.

1042 (IAEA-TECDOC—229, pp 49-53) **Radionuclide accumulation in selected components of the aquatic fauna of the Czechoslovak Danube River section.** Kortus, J. (Water Research Inst., Bratislava, Czechoslovakia). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

Radioactivity concentrations in water and sediment samples were measured. The accumulation of radionuclides in aquatic biota were assessed. The population exposure from fish-food-chain was estimated.

1043 (IAEA-TECDOC—229, pp 127-148) **Chemical behaviour and ecological transfer in the human food chain of some radionuclides in aqueous ecosystems.** Furnica, G. (Academia de Stiinte Medicale, Bucharest (Romania). Inst. de Igiena si Sanatate Publica). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

The aqueous ecosystem of the Danube has been investigated in the period of 1976-1979. Data on the ecological transfer of radionuclides in the human food chain made an estimation available on the risk of the affected population. In the assessment of population exposure, the internal radiation dose for a period of one year and the continuous external irradiation determined by TLD have been considered. - The results revealed very low Sr-90 and Cs-137 contents in the Danube water and in the drinking water. The radioactivity contents are higher in the sediment and in some biota than in the water. The H-3 content in the Danube water varies in a wider range and higher concentration was found in fish than in the water. Both the Danube sediment and the irrigated sandy soil contain very low concentrations of fission products. During 1976-1979, the radioiodine content in air, milk and cow thyroid around the 679-Km is continuously decreasing. - Based on the data obtained, the corresponding collective dose equivalent value was calculated and the risk on the health of the population was found to be very low from contamination during 1975-1978. The radioactivity concentration values in critical human food chain, however, are not negligible.

1044 (IAEA-TECDOC—229, pp 149-152) **General report on radioecological studies and radioactivity monitoring measurements of the Danube River.** Nistor, O.; Furnica, G. (Comitetul de Stat pentru Energia Nucleara, Bucharest (Romania)). 1980. Dep. NTIS (US Sales Only).

In International studies on the radioecology of the Danube River 1976-1979. Report of the IAEA's co-ordinated research programme (1976 to 1979) on the problems of the radioecology of the Danube River.

The system of radioactivity monitoring including national services and international cooperation is described. General average data on the concentrations of a few selected radionuclides like H-3, Cs-137, Sr-90, Ce-144:Pr-144 etc., in the water as well as in aquatic biota are given.

1045 **Field determination of the physical contaminant transport parameters in a sandy aquifer.** Pickens, J.F.; Cherry, J.A. (Waterloo Univ., Ontario (Canada). Dept. of Earth Sciences); Merritt, W.F. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). pp 239-265 of Nuclear techniques in groundwater pollution research. Proceedings of an advisory group meeting organized by the IAEA. Vienna, Austria; IAEA (1980).

From Advisory group meeting on the use of nuclear technology in water pollution studies; Cracow, Poland (6 Dec 1976).

The physical transport parameters necessary for the prediction of contaminant migration in subsurface flow systems are groundwater velocity and dispersivity. Detailed field determination of these parameters has been performed in a sandy aquifer near one of the waste management areas of the Chalk River Nuclear Laboratories (CRNL). Groundwater velocities in the aquifer were (1) estimated using the Darcy equation with a knowledge of the distribution of hydraulic head, hydraulic conductivity and porosity and (2) measured directly using point dilution tests. Values of hydraulic conductivity were determined using four independent methods including a pumping test, single-piezometer response tests, point dilution tests and a tracer test. The point dilution tests proved to be advantageous in indicating directly the zones of highest velocities in the aquifer. The dispersion studies undertaken have involved laboratory column and sandbox experiments, and a field tracer test using the two-well recirculating withdrawal-injection method. The dispersivity values obtained range from 1cm for the column experiments to 10cm and 50cm for the field tracer test. The 50cm value of dispersivity, obtained from analysis of the breakthrough curve at the withdrawal well, is probably an apparent dispersivity resulting from the water samples taken from the well being an integrated mixture of the water flowing into the well over the entire aquifer thickness. This points out the need in dispersion studies for obtaining point samples rather than mixed samples from wells slotted over large intervals. For this purpose, the multilevel point sampler described in this study was shown to be very useful.

1046 **Mobility and retention of $^{60}$Co in soils in coastal areas.** Mahara, Y.; Kudo, A. (National Research Council of Canada, Ottawa, Ontario. Div. of Biological Sciences). pp 1111-1114 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The magnitude of $^{60}$Co mobility was studied in systems of sand sediments and freshwater or seawater under either aerobic or anaerobic conditions, simulating underground environments at coastal areas. The mobility of $^{60}$Co increased at pH values between 6 and 8 in all cases but was highest in the system of seawater under anaerobic conditions. It was also shown that the initial conditions such as aerobic or anaerobic conditions in the sediment and water systems where $^{60}$Co was initially discharged seemed to determine the magnitude of $^{60}$Co mobility. Some of the physical and chemical characteristics of the highly mobile form of $^{60}$Co were evaluated using a dialysis membrane, a chemical extraction and sorption on to sand sediments. The precise nature of the highly mobile cobalt was not determined but it appeared to be stable and able to move freely with the water in the flow systems of underground environments in coastal areas.

1047 **Fate of major radionuclides in the liquid wastes released to coastal waters.** Bhat, I.S.; Verma, P.C.; Iyer, R.S.; Chandramouli, S. (Tarapur Atomic Power Station (India). Environmental Survey Lab.). pp 1087-1090 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The fate of the major radionuclides discharged as liquid wastes into the coastal waters near the Tarapur Atomic Power Station was studied. It was shown that when $^{131}$I, $^{137}$Cs, and $^{60}$Co are released to coastal waters, $^{60}$Co gets almost completely and irreversibly absorbed on the silt but for $^{131}$I and $^{137}$Cs less than 5% gets absorbed. The concentration factors for $^{131}$I, /sup 134+137/ Cs, and $^{60}$Co in three varieties of sea weeds growing near the radioactive waste release point ranged from 3.6 to 2295. These radionuclides were also accumulated by crustaceans and benthos and also to a higher extent than fish in the near shore region. The concentration factors for the radionuclides in sea foods ranged from 6 to 1.36 x $10^3$. A significant amount of the activity was present in the non-edible portion which reduces the intake by man.

1048 **Studies of concentration and transfer factors of natural and artificial actinide elements in a marine environment.** Holm, E. (Lund Univ. (Sweden). Radiofysiska Institutionen); Persson, B.R.; Mattsson, S. (Lunds Lasarett (Sweden)). pp 1103-1106 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The activity levels of natural (thorium and uranium) and artificial (plutonium and americium) actinides in water, sediment and the brown algae Fucus vesiculosus and Fucus serratus were studied at the Swedish south west coast. Lower plutonium and americium concentrations were found in the water samples compared to other areas such as the Atlantic and the Mediterranean. The actinide concentrations of the surface sediments were 3 to 4 times higher than for other regions contaminated from global fallout, indicating significant run off from land. Results of the /sup 239+240/Pu and $^{241}$Am activity concentrations in Fucus during 1967 to 1978 showed that the /sup 239+240/Pu concentration had decreased since the main fallout delivery in 1962. However, the levels of $^{241}$Am had increased during this period which must be related to an in situ build-up from $^{241}$Pu in the environment. The results also indicated that the concentration factor for americium from water to Fucus was higher than for plutonium. A much higher uptake of plutonium than cesium by Fucus was also observed.

1049 **$^{226}$Ra- and $^{222}$Rn-content of drinking water.** Kiefer, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Kerntechnische Betriebe); Wicke, A.; Glaum, F. (Giessen Univ. (Germany, F.R.). Strahlenzentrum); Porstendoerfer, J. (Goettingen Univ. (Germany, F.R.). Zentrales Isotopen-Lab. fuer Biologische und Medizinische Forschung). pp 1107-1110 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Radium-226 and radon-222 concentrations were measured in drinking water in parts of the Federal Republic of Germany. 254 samples were analyzed for $^{226}$Ra, 57 for $^{222}$Rn. The average levels were found to be 4.4 x $10^{-3}$ Bq/l for $^{226}$Ra and 7.4 Bq/l for $^{222}$Rn with maximum values of 0.11 Bq/l and 43 Bq/l, respectively. For both radionuclides there was a log-normal distribution of concentrations. Statistical analysis revealed no correlation between $^{226}$Ra and $^{222}$Rn, both for processed drinking and raw water. It was shown that there was a significant influence of the water processing method on the final content of radioactivity. The average yearly doses to the critical organs were estimated to be about 3 μSv/a for $^{2}2/^{6}$Ra (bone lining) and about 70 μSv/a for $^{2}2/^{2}$Rn (stomach).

### 5205 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 230*

## 53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

### 5301 Social And Economic Studies

*REFER ALSO TO CITATION(S) 229*

1050 **Standardization and workers' protection legislation.** Kliesch, G. pp 131-139 of Technische Normung und Recht. Referate und Diskussionen. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

There are distinct laws guaranteeing the protection of workers in the social and medical field, but the protection of workers in the technical field is based on a simple, general clause relating to technical standards, i.e., to a confusing variety of regulations. The author therefore asks for DIN standards to be set up in order to achieve a consistent and uniform set of rules and regulations. He furthermore points out that it is up to the government to initiate appropriate procedures within the framework of constitutional law toward solving the essential problem, namely that of directly incorporating technical expert knowledge in legal provisions.

1051 **Science and its impact on society: Indian experience. Proceedings of a seminar.** New Delhi, India; Indian National Science Academy (1978). vp. (CONF-7804193—).

From Seminar on science and its impact on society--Indian experience; New Delhi, India (22 Apr 1978).

Individual papers are included in the data base. (PSB)

### 5302 Assessment Of Energy Technologies

1052 **Comparative health risks of energy production.** Parzyck, D.C.; Inhaber, H. (Oak Ridge Natl Lab., TN). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 226-230(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

This study addresses the nature of public and occupational health risks associated with each of the current energy technology alternatives. Technologies including coal, nuclear, and solar will be considered in terms of health impacts per equivalent amount of energy produced. The discussion summarizes the impacts specific to each technology and identifies these aspects of the various fuel cycles that are of greatest concern. Contrasts are drawn between various technological alternatives in order to put the risks associated with the various technologies into a common perspective. 9 refs.

## 55 BIOMEDICAL SCIENCES, BASIC STUDIES

### 5502 Biochemistry

1053 (INIS-mf—6419, pp vp) **Prerequisites and possibilities of small computer processing of RIA results.** Zavada, M.; Ullmann, V.; Safarcik, K. (Krajska Nemocnice s Poliklinikou, Ostrava (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1054 (INIS-mf—6419, pp vp) **Accuracy and sensitivity of plasma renin activity determination.** Topolcan, O. (Karlova Univ., Plzen (Czechoslovakia). Lekarska Fakulta); Zavada, M. (Krajska Nemocnice s Poliklinikou, Ostrava (Czechoslovakia)); Huskova, M. (Karlova Univ., Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1055 (INIS-mf—6419, pp vp) **Determining normal values of plasma renin activity in children.** Huskova, M.; Pellantova, Z. (Karlova Univ., Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1056 (INIS-mf—6419, pp vp) **Iodinated steroid derivatives.** Veres, K. (Ceskoslovenska Akademie Ved, Prague. Isotopova Laborator Biologickych Ustavu); Holik, J.; Pichova, D. (Vyzkumny Ustav Zivocisne Vyroby, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1057 (INIS-mf—6419, pp vp) **RIA properties of iododerivatives of methyl testosterone.** Kozak, I.; Hampl, R.; Lukesova, S. (Karlova Univ., Prague (Czechoslovakia). Biofyzikalni Ustav). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1058 (INIS-mf—6419, pp vp) **Properties of labelled tyrosine analogs of somatostatine in RIA system.** Suba, P.; Cerman, J.; Lomsky, R.; Pribysova, J. (Karlova Univ., Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1059 (INIS-mf—6419, pp vp) **Radioiodination of tyrosine analogs of somatostatine: use of QUSO G 32 adsorbent.** Cerman, J.; Suba, P.; Lomsky, R.; Pribysova, J. (Karlova Univ., Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1060 (INIS-mf—6419, pp vp) **Factors affecting qualitative and quantitative $T_4$ determination by RIA. (Experimental $T_4$ RIA kits).** Mucha, J.; Zimackova, M.; Dobias, M. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)). [nd]. (In Slovak). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1061 (INIS-mf—6419, pp vp) **Problems of tumour antigen determination.** Kimlova, I.; Slouka, V. (Karlova Univ., Prague (Czechoslovakia). Lekarska Fakulta Hygienicka). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1062 (INIS-mf—6419, pp vp) **Nortestosterone RIA using dual antibody system.** Hampl, A.; Picha, J. (Vyzkumny Ustav Endokrinologicky, Prague (Czechoslovakia)); Chundela, B. (Vyzkumny Ustav Zivocisne Vyroby, Prague (Czechoslovakia)); Starka, L. (Laborator pro Kontrolu Dopingu, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1063 (INIS-mf—6419, pp vp) **Czechoslovak-made testosterone RIA kit.** Dvorak, P.; Hampl, R. (Vyzkumny Ustav Endokrinologicky, Prague (Czechoslovakia)); Chrpova, M.; Starka, L. (Vyzkumny Ustav Zivocisne Vyroby, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1064 (INIS-mf—6419, pp vp) **Practical application of hepatitis B antigen and antibody determination by RIA in transfusion services.** Novak, J.; Kselikova, M. (Ustav Hematologie a Krevni Transfuze, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1065 (INIS-mf—6419, pp vp) **Methodology of HBsAg, HBsAb and vitamin B 12 concentration determination by RIA.** Kselikova, M.; Novak, J. (Ustav Hematologie a Krevni Transfuze, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1066 (INIS-mf—6419, pp vp) **Alphaphetoprotein RIA without purchases of kits.** Fingerova, H.; Janouskova, M.; Talas, M. (Palackeho Univ., Olomouc (Czechoslovakia). Fakultni Nemocnice). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1067 (INIS-mf—6419, pp vp) **Triiodothyronine RIA using endogenous antibody. Clinical experience.** Veleminsky, J.; Putz, Z. (Odborny Liecebny Ustav Endokrinologicky, Lubochna (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

## 5503 Cytology

1068 **Simplified method of DNA distribution analysis.** Dean, P.N. (Univ. of California, Livermore). *Cell and Tissue Kinetics;* **13**: 299-308(1980). Contract W-7405-ENG-48.

Current methods of analyzing DNA distributions utilize complex mathematical expressions that require the use of large nonlinear curve fitting methods and, consequently, large computers. This paper presents a new method of analyzing DNA distributions of asynchronously growing or mildly perturbed cells. The S phase fraction is obtained by fitting a second degree polynomial to that part of the distribution, mid S phase, which is not influenced by either the $G_1$ or the $G_2$ + M peaks. The method is simple and fast, it exceeds the accuracy of other methods and it can be used on a large desk calculator or mini-computer.

## 5504 Genetics

1069 **Protein constraints induced by multiframe encoding.** Smith, T.F. (Northern Michigan Univ., Marquette); Waterman, M.S. *Mathematical Biosciences;* **49**: 17-26(1980).

Recent sequencing of viral genomes supports the existence of multiframe codon reading. This study considers the restrictions imposed on proteins coded for in overlapping regions. Calculation of conditional probabilities shows that the restrictions imposed are severe, even at the amino acid-protein structural level. These conditional probabilities are used to calculate conditional information per codon, showing the nonequivalence of the various pairs of reading frames. In addition, the coevolution or primary-secondary evolution of two overlapping proteins should be distinguishable.

1070 **Transcription termination at the end of the early region of bacteriophage T7 DNA.** Dunn, J.J.; Studier, F.W. (Brookhaven National Laboratory, Upton, NY). *Nucleic Acids Research;* **8**: No. 10, 2119-2132(1980).

The nucleotide sequence through the transcription termination site for Escherichia coli RNA polymerase at the end of the early region of T7 DNA has been determined. RNA chains terminate at adjacent residues in the DNA sequence: about 2/3 of the chains end in C and 1/3 in G. A potential stem and loop structure, containing a stem of eight uninterrupted base pairs and a four-base loop, is centered 17-18 bases ahead of the chain termini. Transcription by E. coli RNA polymerase terminates efficiently at this site in vivo and in vitro, but transcription by T7 RNA polymerase is essentially unaffected. The site of termination lies within HpaI fragment Q of T7 DNA. Cleavage sites for other restriction endonucleases are located conveniently for manipulating the DNA sequence around the termination site. The coding sequence for the last 82 amino acids of the T7 DNA ligase protein was identified, as was the beginning of a coding sequence for a possible late T7 protein from beyond the termination site.

## 5505 Metabolism

*REFER ALSO TO CITATION(S) 1173, 1175*

1071 **Nuclear concentration of $^{3}$H-1,25(OH)$_2$ vitamin D3 in cells of pancreatic islets.** Clark, S.A.; Stumpf, W.E.; Sar, M. (North Carolina Univ., Chapel Hill (USA)); Deluca, H.F.; Tanaka, Y. (Wisconsin Univ., Madison (USA). Dept. of Biochemistry). pp 340 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1072 **Pituitary hormone effects on $^{45}$Ca release from fetal rat bones.** Stern, P.H. (Northwestern Univ., Chicago, IL (USA)). pp 385 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1073 **Enterohepatic physiology of 1,25-dihydroxyvitamin D in normal man.** Weisner, R.H.; Kumar, R.; Go, V.L.W. (Mayo Clinic, Rochester, MN (USA)). pp 388 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1074 **Corticosteroid-induced changes in fluxes and in intracellular distribution of calcium in cultured bone cells.** Eilam, Y.; Silbermann, M.; Lewinson, D.; Szydel, N.; Toister, Z.; Harell, A. (Eichilov Hosp., Hadassah Med. Sch. and Technion Med. Sch. Israel). pp 403 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1075 **Delayed stimulatory effect of cyclic AMP on bone resorption.** Lerner, U.; Gustafson, G.T. (Umeaa Univ. (Sweden)). pp 407 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1076 **Quantitative 99mTc-diphosphonate whole body retention, plasma PTH and bone loss in oophorectomized women.** Lindsay, R.; Fogelman, I.; Bessent, R.G.; Beastall, G.; Hart, D.M. (Glasgow Royal Infirmary (UK)). pp 408 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1077 **Measurement of the bone apposition rate by simultaneous labelling of bone formation sites with $^{3}$H proline and tetracycline.** Tam, C.S.; Reimers, S.; Parsons, J.A.; Heersche, J.N.M. (Toronto Univ., Ontario (Canada). Dept. of Pathology). pp 415 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1078 **Role of bone in calcium ion homeostasis: studies with indicator-dilution methods.** Lemon, G.J.; Bassingthwaighte, J.B.; Kelly, P.J. (Mayo Clinic, Rochester, MN (USA)). pp 424 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1079 **Ionized calcium concentrations in Krebs-Ringer bicarbonate buffers (KRBB) and their effect on mineral transport across intestinal mucosa and placenta.** McKercher, H.G.; Radde, I.C.; Whitten, J.; Derewlany, L.O. (Research Institute, The Hospital for Sick Children, Toronto, Canada). pp 425 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1080 **Differences in response of serum calcium, $^{45}$calcium, and $^{3}$H-tetracycline to parathyroid hormone in normal and calcium-deficient dogs.** Wong, K.M.; Klein, L. (Case Western Reserve Univ., Cleveland, OH (USA). School of Medicine). pp 430 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1081 **Comparison of bone resorption and bone-blood calcium equilibrium in vertebrates.** Klein, L. (Case Western Reserve Univ., Cleveland, OH (USA). School of Medicine). pp 447 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1082 **Activity of $^{32}$P inclusion and content of adenylic system components in myocardium of growing rats at $\beta$-adrenergetic block.** Viktorov, A.P.; Matyushko, R.P.; Chernomorets, S.G. (Kievskij Meditsinskij Inst. (Ukrainian SSR)). pp 29-31 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Activity of $^{32}$P, ATP, ADP, AMP and NP inclusions in myocardium when introducing anaprylen $\beta$-adrenoblocker was determined in 7, 30 days and 3-5 months old rats. It is shown that at early stages of ontogenesis myocardium is less sensitive to the blockage of $\beta$ adrenoreceptors.

1083 **Iodine-131 application in studying mechanism of Morshin mineral water effect.** Dmitrieva, G.A.; Dmitriev, I.M. (Odesskij Nauchno-Issledovatel'skij Inst. Kurortologii (Ukrainian SSR)). pp 81-85 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev; Zdorov'ya (1978). (In Russian)

A mechanism of the effect of the Morshin mineral water from the well N6 has been investigated in the Vistar rats by means of radioactive $^{131}$I introduced with sodium iodide and thyroxin as mell as histological investigation of thyroid. It is established that one of the main components of the water is a sulfate ion affecting various organism functions including thyroid.

## 5506 Medicine

*REFER ALSO TO CITATION(S) 755, 1176, 1177, 1214, 1215, 1216, 1217, 1218, 1219, 1220, 1220, 1234, 1236, 1236, 1237, 1238, 1239, 1240, 1241, 1242*

1084 (INIS-mf—6531, pp vp) **Total body irradiation on bone marrow transplantation.** Vowels, M.R.; Heller, E.; Mameghan, H.; Lam-Po-Tang, R. (Prince of Wales Hospital, Randwick (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1085 (INIS-mf—6531, pp vp) **In vivo medical applications of neutrons for diagnosis.** Thomas, B.J.; Thomas, B.W.; Whineray, S. (Queensland Inst. of Tech., Gardens Point (Australia). Dept. of Physics). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1086 **Imaging properties of a positron tomography with 280 bgo crystals.** Derenzo, S.E.; Budinger, T.F.; Huesman, R.H.; Cahoon, J.L.; Vuletich, T. (Univ. of California, Berkeley). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 81-89(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

The basic imaging properties of the Donner 280-BGO-Crystal positron tomograph were measured and compared with the same system when it was equipped with 280 NaI(Tl) crystals. The NaI(Tl) crystals were 8 mm*30 mm+50 mm deep, sealed in 10 mm wide stainless steel cans. The BGO crystals are 9.5 mm wide *32 mm *32 mm deep and as they are not hygroscopic do not require sealed cans. With a shielding gap of 3 cm (section thickness 1.7 cm FWHM) the sensitivity of the BGO system is 55,000 events per sec for 1 /mu/Ci per cm/sup 3/ in a 20 cm cylinder of water, which is 2.3 times higher than the HaI(Tl) system. 24 refs.

1087 **Portable device for the measurement of regional cerebral blood flow in the ICU and Or using Cd Te detectors and a fourier transform based data analysis.** Correia, J.A.; Ackerman, R.H.; Buonanno, F.; Kaufman, D.; Skiver, J.; Alpert, N.; Taveras, J.; Entine, G. (Massachusetts General Hospital, Boston). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 50-54(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

A portable system for the measurement of cerebral blood flow in critical care environments such as the intensive care unit or operating room has been developed and tested in a limited series of patients. The flow measurements are based on the /sup 133/Xe inhalation or IV injection method. The system uses miniature solid state detectors, microprocessor technology and Fourier transform based data analysis to provide compactness and rapid on-line analysis of data. Preliminary patient studies comparing this system with a larger sodium iodide detector system show comparable results. 14 refs.

1088 **Combined application of radiology, nuclear medicine and fine needle aspiration biopsy cytology (FNAB).** Cardozo, P.L.; Ruis, I.A.M. (Rijksuniversiteit Leiden (Netherlands)). pp 29-36 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

The combination of diagnostic cytology and diagnostic radiology, including intervention radiology, is a logical one. Radiology can visualize lesions which cannot be found otherwise and under its guidance cytology can obtain a direct and usually diagnostic proof of the true nature of the process with minimal inconvenience and risk for the patient. A survey of the combination of cytology and radiological procedures in the diagnosis work-up is outlined.

1089 **Therapeutic angiography in acute processes of the alimentary tract.** Roche, A.; Doyon, D. (Hopital de Bicetre, 94 - le Kremlin-Bicetre (France)). pp 68-72 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

Vascular catheterization can be used to perform arterial or venous occlusion or to give intra-arterial drug infusions in acute processes of the gastro-intestinal tract (GI tract). On account of the acute nature of these processes, management by therapeutic angiography requires the same operative conditions as do specialized surgery or re-animation. The protocol must be pre-established in each specialized centre and must always include a preliminary endoscopic examination in every case of GI tract bleeding.

1090 **Diagnostic and therapeutic value of angiography in gastro-intestinal surgical stump haemorrhages.** Oliva, L.; Mallarini, G. (Genoa Univ. (Italy)). pp 73-79 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

Haemorrhage is a very common complication of abdominal surgery. Anastomosis suture stumps are, in the majority of cases, the most frequent source of the bleeding. The respective roles of endoscopy and angiography in this field are considered. Endoscopy is the method of choice here as it can demonstrate the site and the arterial or venous nature of the haemorrhaging. Angiography also reveals the site and type of the haemorrhage and, in addition, it allows detection of esoparietal bleeding, which endoscopy does not. In addition angiography enables the, often critical, evaluation of the collateral circulation of the stump in question which is of fundamental importance for either surgical intervention or for therapeutic angiographic intervention (vasoconstriction or embolization).

1091 **Arterial therapeutic angiography in liver pathology.** Roche, A.; Doyon, D.; Brunelle, F. (Hopital de Bicetre, 94 - le Kremlin-Bicetre (France)). pp 80-85 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

The authors' experience of more than 80 cases of hepatic arterial embolizations performed since 1973 indicates that the technique is particularly useful in inoperable and painful malignant tumoral hepatomegaly, hepatic tumours accompanied by problematic hormonal secretion (paraneoplastic hypoglycaemia or hypercalcaemia), haemorrhages of biliary origin (postoperative, traumatic or tumoral haemobilia), or of arterial origin (tumoral haemoperitoneum). Other applications of the method appear promising but it is still too soon to make any conclusive statement on its value on reduction of tumour size before general chemotherapy and in the treatment of hamartomas. They found that the technique was not very effective in the treatment of cavernous haemangiomas, or as a pre-operative measure aimed at reducing the volume of large hypervascularized tumours.

1092 **Angiographic renal embolization: indications and results.** Simonetti, G.; Rossi, P.; Passariello, R.; Rovighi, L. (Rome Univ. (Italy). Ist. di Radiologia). pp 86-91 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

Therapeutic renal angiography is today a valid method for diagnosis and management of trauma, renal tumours and eventually control of malignant hypertension. Vessel occlusion may be temporary and followed by surgery or permanent as an alternative to surgical treatment. As well as for other abdominal organs, angiography may represent a therapeutic alternative to surgery for control of bleeding from blunt abdominal trauma.

1093 **Intervention radiology in pulmonary thrombo-embolic disease (PTED).** Santos, J.M.; Gallego, J.; Cepeda, T.; Pedrosa, C.S.; Jareno, A. (Hospital San Carlos, Faculty of Medicine, Madrid, Spain). pp 190-195 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

The prognosis and evolution of pulmonary embolism depend on an early diagnosis, which is based on clinical picture, laboratory tests, ECG, chest film, isotopic scanning and pulmonary angiography. Despite the diagnostic importance of all these methods, the authors believe that pulmonary angiography is the most exact since it detects the precise site of obstruction and permits one to evaluate the pulmonary haemodynamic changes produced by the embolism, establishing the prognosis of the lesion according to major or minor arterial involvement.

1094 **Selective spinal angiography and embolization of tumours of the vertebral column.** Stoeter, P.; Voigt, K. (Tuebingen Univ. (Germany, F.R.)). pp 196-201 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

This paper discusses the technique, the diagnostic and therapeutic value, and the limitations of spinal angiography and embolization in tumours of the vertebral column. Three demonstrative selected cases, in which arterial embolization was performed without subsequent surgery, are discussed.

1095 **CT guided percutaneous fine needle aspiration of intra-abdominal and pelvic masses.** Husband, J.E.; Trott, P.A. (Royal Marsden Hospital, Sutton (UK)). pp 340-346 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

This paper describes a technique for performing CT guided fine needle aspiration of abdominal and pelvic lesions and presents the results of aspirations carried out in 21 patients with suspected or known malignant disease. In 1977 criteria were reported for the use of CT compared with ultrasound in the investigation of the pancreas and these apply generally to its application as guiding tool in fine needle aspiration biopsy (FNAB).

1096 **X-ray guided biopsy.** Casanova, R.; Lezana, A.H.; Pedrosa, C.S. (Department of Radiodiagnosis, Hospital San Carlos, Faculty of Medicine, Madrid, Spain). pp 352-357 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

Fine needle aspiration biopsy (FNAB) is now a routine procedure in many X-ray Departments. This paper presents the authors' experience with this technique in chest, abdominal and skeletal lesions.

1097 **New device for isometric localization of nonpalpable breast lesions detected by mammography. Experience in over 100 cases.** del Re Brun, R.M.G.; Stucki, D.; Almendral, A.; Torhorst, J. (Basel Univ. (Switzerland)). pp 624-627 of Gynecology and obstetrics. Proceedings of the IX World Congress of gynecology and obstetrics, Tokyo, Japan, October 25-31, 1979. Sakamoto, S.; Tojo, S.; Nakayama, T. (eds.). Amsterdam, Netherlands; Excerpta Medica (1980).

From 9. world congress of gynecology and obstetrica; Tokyo, Japan (25 Oct 1979).

One of the main problems in localization in mammography is the changing geometry of the breast. It is seldom possible to obtain identical mammograms due to the palpation or rotational effect. The authors have developed a method which aims to satisfy the following conditions: (1) between mammography and localization the isometry must be guaranteed, (2) high accuracy, (3) additional mammographies must be limited to 2, (4) no dependence upon the model of the mammography unit, (5) minimal discomfort for the patient, (6) practicability also in smaller hospitals. The unit and method are described.

1098 **Clinical determination of absolute density in bone utilizing single and dual energy compton scattering.** Huddleston, A.L.; Weaver, J. (Virginia Univ., Charlottesville (USA). Medical Center, Dept. of Radiology). pp 121-125 of Radioaktive Isotope in Klinik und Forschung. Bd. 14. Gasteiner Internationales Symposium 1980. Hoefer, R.; Bergmann, H. (Vienna Univ. (Austria). 2. Medizinische Klinik). Vienna, Austria; H. Egermann (1980).

From 14. international symposium on radioactive isotopes in clinical medicine and research; Bad Gastein, Austria (9 Jan 1980).

Several methods important in the clinical diagnosis of skeletal diseases have been proposed for the determination of bone mass, such as photon absorptiometry, computed tomography, and neutron activation. None of these present methods provides for the determination of the physical density of bone. In the Radiological Physics Research Laboratory at the University of Virginia, the principles of Compton scattering are being investigated with the intent of determining the electron density and the physical density of human bone. A Compton-scatter densitometer has been constructed for the in vivo density determination of the femoral head. This technique utilizes of collimated low energy gamma source and detector system. The method has been tested in cadavers and in known density samples and has an accuracy of 2 %. A second densitometer has been designed for the in vivo determination of electron density of the vertebrae based upon a new technique which employs dual energy Compton scattering in the spinal column. These systems will be discussed; and the principles of dual energy Compton scatter densitometry will be presented. The importance of these isotope techniques and the feasibility of in vivo density determination in the vertebrae and femoral head will be discussed as they relate to clinical diagnosis and research.

1099 **Steroid receptors, metabolism and prostatic cancer. Workshop of the Society of Urologic Oncology and Endocrinology, Amsterdam, Netherlands, April 27-28, 1979.** Schroeder, F.H.; de Voogt, H.J., (eds.). Amsterdam, Netherlands; Excerpta Medica (1980). vp. (CONF-7904171—).

From Workshop of the Society of Urologic Oncology and Endocrinology; Amsterdam, Netherlands (27 Apr 1979).

Separate abstracts have been prepared for individual items within scope for inclusion in the Energy Data Base.

1100 **Diagnostic value of radioisotopic methods of study in liver diseases.** Marega, I.N.; Butvin, G.K.; Kavkalo, N.N.; Zajdman, V.E. (Chernovitskij Meditsinskij Inst. (Ukrainian SSR)). pp 45-47 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

It is established as a result of radiological examination of 3500 patients that the moderate decrease of vascular capacity and absorption function of liver is characteristic of chronic injuries of biliary tracts. This fact can serve as a differential-diagnostic test for the separation of hepatitis - a companion of chronic cholecystoangiocholitis and virus hepatitis. It is also found that hepatocirrhosis is characterized with more pronounced disturbances of vascularization, absorption rate and isotope excretion as compared with chronic hepatitis.

1101 **Radioisotope diagnosis in vitro in clinical examinations. Chapter 10.** Gabuniya, R.I.; Tkacheva, G.A. pp 245-258 of Primenenie radioaktivnykh nuklidov v klinicheskikh issledovaniyakh. Gabuniya, R.I. (ed.). Moscow, USSR; Atomizdat (1979). (In Russian)

Considered are the radioimmunologic method, the method of competitive binding with albumen and radioreceptor method with the use of $^{131}$In and $^{125}$I radionuclides in clinic investigations in the field of endocrinology, hypophysial disorders etc. Described are the methods of determination of the insulin concentration in blood plasma with the radioimmunologic method. The methods of determining cortisone concentrations in biological liquids is described as well as the methods of thyroxine determination using the method of competitive binding with albumen. Stated are such advantages of the above in vitro diagnostics methods as high specificity, sensitivity and high informativeness.

1102 **Clinical and economic aspects of radiotherapy of nontumoral diseases.** Granovskaya, N.N.; Prosvirov, V.P. (Krymskij Meditsinskij Inst., Simferopol' (Ukrainian SSR)). pp 83-87 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

The experience on 3251 patient X-ray therapy with different nontumoral diseases has been generalized. The irradiation technique is described in detail, the characteristics of the clinical progress of disease and estimate of treatment resUlts are given. High therapeutic and economic efficiency of the X-ray therapy is shown.

1103 **Changes in the level of thyrotropic hormones of hypophysis of radioiodinetherapy of thyrotoxicosis.** Livergant, Yu.E.; Krupchitskaya, K.I.; Lozinskaya, I.N. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 91-93 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

Content of thyrotropic hormone of hypophysis (THH) in blood plasma of 120 patients with thyrotoxicosis and 32 healthy persons has been investigated by the radioimmunoassay. According to the average data a hormone level in patients is slightly higher but confidential intervals of indices are in norm and exceeded during thyrotoxicosis. In 7-10 days after treatment with $^{131}$I there was no the pronoUnced increase of THH concentration in patient blood. In 3-5 months after treatment the THH level sharply increases when disappearing thyreotoxicosis symptoms and remains former at the absence of remission.

1104 **Effective renal blod flow and canalicular function of kidneys with obliterating endarteritis.** Davydova, L.I.; Zaitsev, V.T.; Kononenko, E.I.; Gorbenko, L.V.; Karpovich, I.P.; Troyan, V.I.; Skripko, V.A.; Belousova, L.G.; Pavlova, T.S. (khar'kovskij Nauchno-Issledovatel'skij Inst. Obshchej i Neotlozhnoj Khirurgii (Ukrainian SSR)). pp 72-74 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Effective renal blood flow (general and separate) as well as the secretory-evacuatory function of the canalicular system of kidneys in 39 patients with obliterating endarteritis and in 20 persons of a control group have been studied by means of hippuran $^{131}$I. Considerable decrease in the effective renal blood flow has been revealed. The decrease in blood flow with the increase in the ischemia degree turned out to be insignificant. The total function of kidneys is reduced in the 2-5 stages of diseases. Indices of secretory - evacuatory function of canals were changed. Indices of the total function of kidneys and intrarenal hemodynamics are the most informative when studying the state of this organ.

1105 **Radioisotopic renography in the evaluation of rehabilitation of children operated on the occasion of hydronephrosis.** Mil'ko, V.I.; Tereshenko, A.V.; Moskalenko, N.I.; Pinchuk, V.P.; Kazachek, T.N. (Kievskij Meditsinskij Inst. (Ukrainian SSR)). pp 75-79 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

The results of estimating recovery ability of kidneys in children operated in connection with hydronephrosis of different etiology are stated. Radioisotopic renography with $^{131}$I hippuran was used in investigations. Distinct dependence between a hydronephrosis degree and a change character of isotopic renogram indices before operations is noted. An analysis of the same indices after operations has shown a considerable improvement in the function of operated and contralateral kidneys. Divergence in the estimation of rehabilitation from the clinic data, X-ray contrast and radiological methods is noted.

1106 **Study on after-actions of transient damages of cerebral circulation in patients with erythremia by the radiocirculography method.** Vladimirova, A.F. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 69-72 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

The state of cerebral circulation in 112 patients with erythremia has been studied by the radiocirculography (RCG) method before treatment and with the coming of remission. Among the patients with transient damages of cerebral circulation 92% of patients had a clear asymmetry in RCG, remaining in 71% of cases with the coming of remission. It is established when comparing the data on the clinico-radiologic investigations that after transient damages of cerebral circulation the hemodynamics of cerebrum remains unchangeable even at the total absence of neurologic symptomatology.

1107 **Iodine accumulating activity of thyroid autoplastic graft in the early period after subtotal resection of thyroid.** Natarov, V.V.; Tsarikovskaya, N.G.; Tkach, F.S.; Alyushin, A.S.; Sheverdin, Yu.P. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Ehndrokrinologii i Khimii Gormonov (Ukrainian SSR)). pp 61-63 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

Iodine accumulating activity of thyroid autoplastic graft in 14 persons with euthyroid state in 12-13 days, in 23 persons - in 2-4 months after subtotal resection of thyroid has been investigated for the subsequent determination of its functional state. In 2-4 months after the operation the function activity of thyroid increases almost two times as compared to the data, obtained in 10-12 days after surgical therapy. In 10-12 days and 2-4 monts after the operation a high rate of $^{131}$I capture for the first several hours of radioiodine indication and a low level of its accumulation in autoplastic graft in 24 h after the isotope administration are observed. Indices of iodine-accumulating activity of thyroid autoplastic graft in 10-12 days and 2-4 months after the operation significantly do not differ. $^{131}$I accumulation curve, likely, testifies to the functioning of thyroid autoplastic graft.

1108 **Radioisotopic study on the thyroid after surgical treatment of patients with different form of goiter.** Beletskii, V.I.; Tarasenko, Yu.I. (Donetskij Meditsinskij Inst. (Ukrainian SSR)). pp 54-56 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

Results of radioisotopic scanning of 48 patients during delayed periods after operations of thyroid on the occasion of diffuse, node and mixed goiters have been analyzed. Specific peculiarities of residue representation depending on a type of surgical intervention of thyroid are revealed. Determined are sizes of thyroid residue and intact shares after the operation as well as their absolute sizes from scannograms being a criterium of normal sizes.

1109 (INIS-mf—6419, pp vp) **Importance of HCG determination for the diagnosis of extrauterine pregnancy.** Fignerova, H.; Talas, M. (Palackeho Univ., Olomouc (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1110 (INIS-mf—6419, pp vp) **Complex diagnosis of thyroid gland disease by in vitro tests without using expensive commercial kits.** Safarcik, K.; Zavada, M.; Mueller, J. (Krajska Nemocnice s Poliklinikou, Ostrava (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1111 (INIS-mf—6419, pp vp) **Acute effect of haemodialysis on thyroid hormone level.** Koslik, S.; Machanova, Y.; Mikula, L. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Lekarska Fakulta); Gondol, J. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)). [nd]. (In Slovak). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1112 (INIS-mf—6419, pp vp) **Testosterone concentration in mother's serum and in amniotic fluid.** Dvorak, P.; Hampl, R. (Vyzkumny Ustav Endokrinologicky, Prague (Czechoslovakia)); Macek, M. (UVVD Prague (Czechoslovakia)); Chrpova, M. (Vyzkumny Ustav Zivocisne Vyroby, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1113 (INIS-mf—6421, pp 7) **Diagnosis of bone metastases in breast carcinoma by isotope technique with abbreviated recording.** Svobodova, M.; Ilievova, M.; Kudlickova, Z.; Hlavkova, J. (Vyzkumny Ustav Klinicke a Experimentalni Onkologie, Brno (Czechoslovakia)). [nd]. (In Czech and German). Dep. NTIS (US Sales Only).

From Diagnosis of mammary gland disorders; Piestany, Czechoslovakia (3 Oct 1979).

## 5507 Microbiology

*REFER ALSO TO CITATION(S) 1069, 1070, 1204*

1114 **Colonization of artificial substrates by protozoa: replicated samples.** Cairns, J. Jr.; Plafkin, J.L.; Yongue, W.H. Jr.; Kaesler, R.L. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Archiv fuer Protistenkunde;* **118**: 259-267(1976).

Six sets of ten polyurethane foam substrates were placed at different times and at two different sites in Douglas Lake, Michigan. After various periods of exposure, sets of ten substrates were sampled and the composition of the colonizing protozoan assemblages determined. Cluster analyses indicate generally good replication between substrates within a set. Differences between long exposed sets (3 months - 1 year) and relatively short exposed sets (9 days - 3 weeks) were most pronounced. Fall overturn appears to stimulate an increase in mean species numbers but reduces replicability.

## 5509 Pathology

*REFER ALSO TO CITATION(S) 1119, 1121, 1235*

1115 **Method of radioisotopic indication with chromium-51 in the evaluation of circulating blood volume in persons of different age.** Lutsenko, S.M.; Lomakin, M.M.; Gritsenko, S.N.; Bannyj, A.V.; Pokh-Drobantsev, V.V. (Zaporozhskij Meditsinskij Inst. (Ukrainian SSR)). pp 67-69 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

The results of investigations into a circulating blood volume, circulating crythrocytes volume and circulating plasma volume are presented for persons of young, middle and elderly ages. No considerable changes in the circulating blood volume are revealed in persons of middle and elderly ages as compared to the young persons.

1116 **Peculiarities of liver affection in chronic alcoholic intoxication according to the data of radioisotopic and biochemical study methods.** Romas', R.S.; Volkova, A.A.; Melimuka, A.I.; N., I.F. (Ternopol'skij Meditsinskij Inst. (Ukrainian SSR)). pp 51-53 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Examination of 74 patients with alcoholism has shown disturbance of albuminous function of liver during alcoholic intoxication. It is established that these disturbances combine with considerable changes in hepatoscanograms.

1117 **Application of radioisotopic indication by chromium-51 in diagnosis of injuries of circulating blood volume in local peritonits.** Bannyi, A.V. (Zaporozhskij Meditsinskij Inst. (Ukrainian SSR)). pp 88-91 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Fifty-nine patients with local peritonitis caused with destructive appendix (49 patients), destructuve cholecystitis (7 patients) and other reasons (3 patients) have been examined. Seventy-two healthy persons constituted a control group. Venous hematocrit and circulating blood volume (CBV) were determined. It is established that there is CBV deficit in the first and third days after the operation in all the age groups. CBV was normalized till the seventh day in persons of young and middle ages, in elderly and aged persons its deficit was conserved till that time. The decrease in CBV in elderly and aged persons is more pronounced as compared with persons of young and middle ages.

## 5510 Physiological Systems

1118 **New tomograph for quantitative positron emission computed tomography of the brain.** Hoffman, E.J.; Phelps, M.E.; Huang, S.C.; Kuhl, D.E.; Crabtree, M.; Burke, M.; Burgiss, S.; Keyser, R.; Highfill, R.; Williams, C. (Univ. of California, Los Angeles). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 99-103(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

A new system (NEUROECAT) has been designed and built for quantitative positron emission computed tomography (PCT) of the brain. It consists of three octagonal arrays of bismuth germanate detectors (BGO) providing 5 simultaneous image planes. The design utilizes unique shielding and detector geometries which optimize uniformity in image and axial resolution and also minimize scatter and accidental coincidence rates. The basic system image resolution is 11.0/plus or minus/.4 mm FWHM with a total system sensitivity of 270,000 counts/sec/microcurie/cc uniformly dispersed in a 20 cm diameter cylinder. 20 refs.

1119 **Epidemiological follow-up research within a geographically stable population.** Helgason, T. pp 73-85 of Psychiatrische verlaufsforschung: methoden und ergebnisse. Schimmelpenning, G.W. (ed.). Bern Switzerland; Verlag Hans Huber (1980).

A population which remains stable within a geographically defined area offers advantages in follow-up research, clinical or epidemiological, provided the area is not too large. During the last 80 to 90 years the population of Iceland has remained relatively stable within the boundaries of the country. This fact has made it possible to study the epidemiology of mental disorders by following a cohort of all Icelanders born during a certain period of time to their death or to the age of 60 to 62 years. From the results of such a study the expectancy of developing a mental disorder before the age of 61 years was estimated to be 32.5% for men and 35.3% for women. The epidemiological description is, however, deficient as it does not include mental disorders occuring after this age. In the present paper the relation between the diagnoses of organic and functional mental disorders before and after the age of 61 years will be presented. Within the functional disorders the incidence for depressive syndroms will be given. Further, the overall expectancy of mental disorders up the age of 74 years will be estimated. Finally, the outcome of the above-mentioned groups of mental disorders will be compared with those without mental disorders.

1120 **Activity of $^{32}P3$ inclusion and glycogen content in rat myocardium following alpha-adrenergic blockade.** Viktorov, A.P.; Matyushko, R.P. (Kievskij Meditsinskij Inst. (Ukrainian SSR)). pp 67-69. of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

$^{32}P$ inclusion and glycogen content in myocardium in 7.30 days and adult (3-5 months) rats when administering phentolamine hydrochloride alpha adrenolytic drug have been studied. It is shown that at early stages of postnatal ontogenesis the animals are more sensitive to phentolamine hydrochloride as compared to aduit animals.

1121 **Permeability state of microcirculatory channel of some organs in rabbits under conditions of pyocyanic infections process.** Dzyubak, S.T.; Dzyubak, A.D. (Ivano-Frankovskij Meditsinskij Inst. (Ukrainian SSR)). pp 92-94 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Permeability of microcirculatory bed of some organs during experimental pyocyanic sepsis has been studied in experiments carried out on 10 rabbits. $^{131}I$-albumin was used as an indicator of permeability. A more pronounced decrease of label radioactivity in animal blood has been established which testifies to the increase in total permeability of microcirculatory bed of organs. A label concentration in tissues of lungs, liver, myocard grows. Permeability of the microcirculatory bed of brain, hypophysis and adrenals considerably increases. The most pronounced increase in permeability of capillaries is observed in organs related to immunogenesis.

## 5530 Agriculture And Food Technology

*REFER ALSO TO CITATION(S) 1002, 1004*

1122 (IAEA-TECDOC—236, pp 44-51) **Isotope versus the total balance method to assess nutrient losses and erosion risks.** de Boodt, M.; van den Berghe, C.; van Outryve-D'Ydewalle, Y. (Ghent Rijksuniversiteit (Belgium)). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Fertilizer K erosion through runoff, percolation and soil splashing was measured by labelling three soils with K-42 fertilizer and subjecting them to simulated rainfall. The erosion estimates were similar to those obtained by the much more laborious procedure of chemically analyzing the fractions for K. The isotope method offers the additional advantage that the K originating from soil can be differentiated from that derived from the applied fertilizer in a single operation.

1123 (IAEA-TECDOC—236, pp 66-74) **Dynamic aspects of soil organic matter and its relationship to the physical properties and fertility of soils.** Wagner, G.H. (Missouri Univ., Columbia (USA)). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Soil organic matter plays a critical role in determining the physical, chemical, and biological nature of soils. Its dynamic nature is explored with reference to the cycling of C and N in the biosphere. Optimum soil structure is developed under a grass sod, but adequate water stable aggregates can be maintained under proper cultivation to ensure deep root penetration, rapid water infiltration for storage in the rooting zone, and the prevention of surface crusting. Perhaps the most important role of organic material is its prevention of soil erosion by directly stabilizing the soil during the growing season, providing residues for protection between crops, and improving surface aggregation to make the soil less subject to erosion.

1124 (IAEA-TECDOC—236, pp 75-85) **Remote assessment of soil moisture.** Reginato, R. (US Water Conservation Lab., Science and Education Administration - Agricultural Research, Department of Agriculture, Phoenix, AZ). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Soil moisture can be estimated in the upper few centimeters of the soil profile by three separate remote sensing techniques. The simplest and least costly method uses the ratio of reflected to incoming solar radiation (albedo). Just as simple, but more costly for equipment, is the use of emitted thermal radiation. Surface soil temperature and air temperature are the only measurements required to estimate water content near the soil surface. Both active and passive microwave techniques can be used to infer soil water content, potentially to depths of 10 cm; however, they require more sophisticated and bulky equipment than the other two methods.

1125 (IAEA-TECDOC—236, pp 86-94) **Research techniques in soil moisture regimes under rain-fed agriculture.** Barrada, Y. (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Year around measurements of moisture content in soil profiles are essential for a good understanding of soil water and nutrient dynamics, which allow for proper evaluation of management alternatives. The various methods of soil moisture determination are described and the advantages as well as the limitations of each of the mentioned methods are discussed. Also the principals involved in the use of different types of radiation equipment to follow moisture changes in soil profiles are indicated in some detail.

1126 (IAEA-TECDOC—236, pp 95-106) **Some aspects in relation to the efficient use of soils, water and fertilizers in Egypt.** El-Kholi, A.F. (Atomic Energy Establishment, Cairo (Egypt)). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Only 3% of the land area of Egypt is cultivated. Efforts have been directed to the irrigation and cultivation of new lands and the reclaimation of saline and sodic lands to meet the demands of a rapidly increasing population. Isotopic techniques can play a major role in reclaimation schemes by allowing the direct measurement of Na exchange and leaching, and of water storage and utilization. Mutation breeding could be important in developing stress tolerant plants. Water is the main limiting resource in Egypt. Water conservation measures have included the liming of irrigation canals, improved irrigation efficiency, drainage water and ground water utilization and nuclear desalinization.

1127 (IAEA-TECDOC—236, pp 115-139) **Effect of desertification and soil salinity on land productivity in the Sudan.** El-Karouri, M.O.H. (National Council for Research, Khartoum, Sudan). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Although the Sudan contains one of the largest reserves of cultivable and irrigable land in the world, desertification and salinization have had a severe effect on soil productivity. Irrational cultivation of marginal lands and the abuse of tractor power have led to severe erosion problems. Deforestation, overgrazing and the use of fire in land clearing have destroyed natural vegetation. Desertification has claimed most of the land between latitudes 15° and 17°N and continues to move rapidly. The wild life habitants has been drastically altered with many species becoming extinct. Conflicts have arisen between nomads and cultivators. The government has thus developed a six year programme with emphasis on range seeding, afforestation, water conservation, fire control, sand dune stabilization and shelter belt development. Soil salinity and sodicity present both chemical and physical soil problems especially in irri-

gated regions. Since the Sudan is increasing its irrigated area from 2 to 4 million ha the problems will increase. Gypsum has not been effective in reclaimation but cultural practices such as ridge planting, timely seeding, and crop selection have shown promise.

1128 (IAEA-TECDOC—236, pp 140-146) **Soil erosion, fertility and water conservation factors in agricultural activities in Kenya: A look at problems and efforts being made to solve them using radioisotope techniques.** Gitonga, J. (National Agricultural Labs., Ministry of Agriculture, Nairobi, Kenya). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Inadequate nutrient supply is the major factor limiting production in the adequately rainfed region of Kenya around Lake Victoria. Phosphorus is particularly deficient and its availability difficult to determine. Soil P availability and optimum fertilizer P placement is being determined with $^{32}P$. Serious soil erosion problems have been reduced by establishing tea on the steep slopes. The uneven rainfall distribution on the lowlands results in serious soil and water conservation problems. Residue management and terracing have provided erosion protection. Neutron probes have been used to measure water conservation. Stress tolerant crops such as an early maturing maize have proven useful. The role of International Organizations in supporting the research activities is acknowledged.

1129 (IAEA-TECDOC—236, pp 147-153) **Contribution of the Land and Water Development Division of FAO to soil and water conservation in developing countries.** Massoud, F.I. (Food and Agriculture Organization of the United Nations, Rome (Italy)). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

The Land and Water Development Division of FAO has played an active role in promoting soil conservation measures. It has provided advice and expert assistance to many countries and is involved in more than fifty field programmes related to soil conservation. It conducts seminars, workshops, and training courses and provides fellowships for individuals. Technical and education material has been published. Maps have been developed showing the present degradation and risk of degradation in Africa and methodology used in assessment of soil degradation is outlined.

1130 (IAEA-TECDOC—236, pp 10-25) **Water conservation in semiarid dryland agriculture.** Willis, W.O. (United States Department of Agriculture, Science and Education Administration - Agricultural Research, Fort Collins, CO). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Factors affecting water conservation in semiarid dryland regions are discussed. Because precipitation is the only source of water for plant growth in most semiarid regions, a good understanding of precipitation patterns (quantity, distribution, and their probable frequency) is needed for each dryland area. The various dryland practices, e.g. tillage, cultivars, residue management, fertility, erosion control, and grazing, must be considered as integral parts of an entire system to develop best management practices and to gain most efficient water conservation for food and fiber production.

1131 (IAEA-TECDOC—236, pp 52-65) **Oued Zeroud watershed management and Sidi Saad Dam protection.** Gargouri, T. (Ministry of Agriculture, Forestry Dept., Kairouan, Tunisia). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

The Government of Tunisia has decided to construct the Qued Zeroud Dam to protect Kairouan from flooding, to irrigate 4,080 ha, and to maintain the groundwater supply. To prevent silting of the dam 100,000 ha of the Qued Zeroud watershed will undergo a conservation programme. Terraces, waterways and drop structures will be constructed and forage and tree plantations will be developed using Atriplex and cactus. Cultural and grazing practices will be controlled.

1132 (IAEA-TECDOC—236, pp 107-114) **Review of soil conservation in the Sudan (1940-1979).** Awadalla, M.S.; Badawi, A.E. (Soil Conservation Land Use and Water Programming, Khartoum, Sudan). Dec 1980. Dep. NTIS (US Sales Only).

From Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region; Khartoum, Sudan (12 Nov 1979).

Soil Conservation in the Sudan started in the late thirties, and in 1942 a Soil Conservation Committee was set up to report on Soil Conservation Situation. Later a Soil Conservation Section was set which developed into a department taking the responsibility of drinking water points distribution and soil and water management in rural areas. In 1974 a desert encroachment project was proposed to cover most affected areas with the help of F.A.O. Soil Conservation is an important problem in Sudan and much work is needed to tackle this problem. The application of radioisotope and radiotracer techniques are also needed for tackling this problem.

1133 (INIS-mf—6420, pp vp) **Mission of the central commission of the Czechoslovak Academy of Agriculture for use of energy resources and nuclear methods in agriculture.** Horacek, P. 1979. (In Czech). Dep. NTIS (US Sales Only).

From National seminar on the use of energy resources in agriculture and food; Olomouc, Czechoslovakia (13 Dec 1978).

The possibility is discussed of using waste heat of nuclear power plants for the intensification of agricultural production. In France, protected agricultural areas are heated with warm water circulating in a polyethylene perforated blanket. Experiments with subirrigation using warm water or with heating using water circulating in subsurface piping yield good results. Heating water for fish husbandry appears prospective and a research project in this field is suggested.

1134 (INIS-mf—6420, pp vp) **Use of nuclear heat for a food and agricultural complex. Conclusions of model solution for reference locality of WWER type power plants in Czechoslovakia.** Nesvadba, M. (Energoprojekt, Prague (Czechoslovakia)). 1979. (In Czech). Dep. NTIS (US Sales Only).

From National seminar on the use of energy resources in agriculture and food; Olomouc, Czechoslovakia (13 Dec 1978).

A state research programme is described for using waste heat from nuclear power plants in Czechoslovakia in the food and agricultural industries. The principal uses include the heating of agricultural buildings, such as hothouses, farm outhouses etc., irrigation of fields and orchards, and the drying and freeze-drying of vegetables and medicinal herbs. Waste heat is classified into categories depending on outlet pressure and temperature. Two model areas are described in detail where the research programme is to be practically tested.

1135 (INIS-mf—6420, pp vp) **Complex use of nuclear energy resources in Czechoslovakia.** Zaduban, M.; Pezlar, O. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)). 1979. (In Slovak). Dep. NTIS (US Sales Only).

From National seminar on the use of energy resources in agriculture and food; Olomouc, Czechoslovakia (13 Dec 1978).

The use of nuclear power plant waste heat in agriculture in Czechoslovakia is part of a complex project which involves environmental control. The Institute of Radioecology in Kosice has suggested that the project be included in the state research programme "Environmental Development from the Complex Use of Nuclear Power". The project assesses selected localities with respect to the improvement of the environment resulting from nuclear power facilities.

1136 **Improved use of plant nutrients.** Rome, Italy; Food and Agriculture Organization (1978). vp. (CONF-7704126—).

From Expert consultation on better exploitation of plant nutrients; Rome, Italy (18 Apr 1977).

Separate abstracts have been prepared for inclusion in the Energy Data Base.

# 56 BIOMEDICAL SCIENCES, APPLIED STUDIES

## 5601 Radiation Effects

*REFER ALSO TO CITATION(S) 179, 239, 539, 991, 1041, 1052, 1071, 1107, 1245, 1246*

1137 (INIS-mf—5673, pp 23-24) **Comparative assessment of methods of determination of initial sowing and contaminant radiosensitivity.** Ramkova, N.V. 1978. (In Russian). Dep. NTIS (US Sales Only).

From 1. all-union scientific--technical conference on medical production radiation sterilization; Moscow, USSR (24 Oct 1978).

1138 (INIS-mf—5673, pp 30-31) **Application of combined ultraviolet and gamma-radiation effect for medical instruments sterilization.** Studenikina, F.G.; Dmitrieva, Eh.A.; Dobrovol'skaya, G.F. 1978. (In Russian). Dep. NTIS (US Sales Only).

From 1. all-union scientific--technical conference on medical production radiation sterilization; Moscow, USSR (24 Oct 1978).

1139 (INIS-mf—5673, pp 42-44) **Prospects of gamma-radiation application in bacteritic vaccine production.** Tumanyan, M.A.; Duplishcheva, A.P.; Sinilova, N.G. 1978. (In Russian). Dep. NTIS (US Sales Only).

From 1. all-union scientific--technical conference on medical production radiation sterilization; Moscow, USSR (24 Oct 1978).

1140 (INIS-mf—5673, pp 47-49) **Some theoretical problems of biological evaluation of medical polymer articles sterilized with radiation.** Bovenko, V.N.; Koshevaya, V.P. 1978. (In Russian). Dep. NTIS (US Sales Only).

From 1. all-union scientific--technical conference on medical production radiation sterilization; Moscow, USSR (24 Oct 1978).

1141 (INIS-mf—6050, pp 282-284) **Effect of gamma irradiation on the lysine content of plants.** Benedekne-Lazar, M. (Agrartudomanyi Egyetem, Goedoelloe (Hungary)). 1979. (In Hungarian). NTIS (US Sales Only).

From Symposium on the possibilities of the application of irradiation in agriculture and food industry; Budapest, Hungary (15 Mar 1979).

It has been proved by studies on the physiological effect of ionizing irradiation that in plant metabolism important changes take place. From the endosperm of seven-day-old seedlings $^{14}$C-L-Lysine is transported faster to organs, especially to shoots and its incorporation into protein is also more intensive. The animation of the growth of roots and shoots can be observed on 14-day-old plants grown in water culture. In sand culture a surplus in dry weight can be experienced after 56 days for maize, under the influence of 100 rad. Two soybean varieties (Merit, Clay) responded different to irradiation. The dry weight of the Merit variety was increased significantly by 500 and 1000 rad, whereas that of the Clay variety decreased or did not change significantly. The lysine content of plants changes in the function of growth. In the case of the two maize varieties (Szegedi sarga, KSC 360) treatments with 1000 and 5000 rad resulted in an essential surplus of the total lysine content (46.25 and 31.21%, respectively). The total lysine content of the Merit variety has been increased by about 23.9% and 20.92%, respectively. 5000 rad treatment resulted in a negative correlation (-0.77) in the shoots. The total lysine content of the Clay plants was lower than that of the control. Under the influence of 500 and 1000 rad treatments the total lysine content of the shoots of the Merit variety grown in fields increased to a lesser extent (16.82 and 3.19 respectively) than that of plants grown in a climate room.

1142 (INIS-mf—6304, pp vp) **Fundamentals of the theory of radiation impact processes in crystalline amino acids, proteins and quasiperiodic biological structures. Pt.2.** Komar, I.N. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1980. (In Russian). Dep. NTIS (US Sales Only).

From 3. national conference on biomedical physics and engineering with international participation; Sofia, Bulgaria (25 Oct 1980).

1143 (INIS-mf—6531, pp vp) **Research activities of the Medical Research Council's Radiobiology Unit at Harwell, Great Britain.** Holmes, R.S. (Griffith Univ., Brisbane (Australia). School of Science). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1144 (INIS-mf—6531, pp vp) **Studies of radiation induced hemolysis of erythrocytes.** Brown, M.A.; Gebicki, J.M. (Macquarie Univ., North Ryde (Australia). School of Biological Sciences). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1145 (INIS-mf—6531, pp vp) **Response of cultured mouse lymphoid cell lines to x-irradiation.** Lowenthal, J.W.; Harris, A.W. (Walter and Eliza Hall Inst. of Medical Research, Parkville (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1146 (INIS-mf—6531, pp vp) **Evidence for an indirect effect of radiation on mammalian chromosomes.** Kellow, G.N.; Graves, J.M. (La Trobe Univ., Bundoora (Australia). Dept. of Genetics). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1147 (INIS-mf—6531, pp vp) **Cell production and loss rates in basal and squamous cell carcinomata, before and after irradiation.** Jenkinson, I.S.; Moore, F.J. (Saint Vincent's Hospital, Darlinghurst (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1148 (INIS-mf—6531, pp vp) **Role of ultraviolet light in bovine ocular squamous cell carcinoma (BOSCC:.** Lavin, M.; Jennings, P. (Queensland Univ., St. Lucia (Australia). Dept. of Biochemistry). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1149 (INIS-mf—6531, pp vp) **Studies of DNA repair and chromosome aberrations in two unusual DNA repair deficient individuals.** Chen, P.; Ramsay, R.; Imray, P.; Kidson, C. (Queensland Inst. of Medical Research, Brisbane (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1150 (INIS-mf—6531, pp vp) **Induction of DNA polymerase activity in irradiated Chinese Hamster cells.** Westerman, M.; Ramsey, R. (La Trobe Univ., Bundoora (Australia). Dept. of Genetics). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1151 (INIS-mf—6531, pp vp) **Yield of sister unions as a function of x-ray dose.** Moore, R. (Cancer Inst., Melbourne (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1152 (INIS-mf—6531, pp vp) **Radiation sensitivity of tetrahymena pyriformis.** Baumgartner, S.; Darlington, J.; Gebicki, J.M. (Macquarie Univ., North Ryde (Australia). School of Biological Sciences). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1153 (INIS-mf—6531, pp vp) **Radiation effects on electrophoretic properties of bacterial spores.** Izard, M.E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Isotope Div.). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1154 (INIS-mf—6531, pp vp) **Genetic characterisation of radiation-sensitive mutations of the slime mould Dictyostelium discoideum.** Welker, D.L. (Australian National Univ., Canberra. Research School of Biological Sciences). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1155 (INIS-mf—6531, pp vp) **R-plasmid mediated repair in Pseudomonas aeruginosa.** Lehrbach, P.R.; Kung, A.H.C.; Atkinson, P.; Lee, B.T. (Melbourne Univ., Parkville (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1156 (INIS-mf—6531, pp vp) **Effect of bacteriophage C5 on ultraviolet survival in Pseudomonas aeruginosa.** Dirckze, C.D.; Lehrbach, P.R.; Lee, B.T.O. (Melbourne Univ., Parkville (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1157 (INIS-mf—6531, pp vp) **Mechanisms of radiation induced mutability in bacteria.** Lehrbach, P.R.; Lee, B.T.O. (Melbourne Univ., Parkville (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1158 (INIS-mf—6531, pp vp) **Plasmid modification of spontaneous and radiation-induced mutability in Pseudomonas aeruginosa.** Lehrbach, P.R. (Melbourne Univ., Parkville (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1159 (INIS-mf—6531, pp vp) **Frameshift mutagenesis by ultraviolet and gamma radiation.** Leyden, M.; Imray, P.; Schoeffel, K.; MacPhee, D.G. (La Trobe Univ., Bundoora (Australia). Dept. of Genetics). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1160 (INIS-mf—6531, pp vp) **In vivo study of effects of ionizing radiation in rabbit ear chambers.** Narayan, K.; Cliff, W.J. (Australian National Univ., Canberra. John Curtin School of Medical Research). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1161 (INIS-mf—6531, pp vp) **Morphology and ultrastructure of radiation induced tissue damage in rabbit ear chambers.** Cliff, W.J.; Narayan, K. (Australian National Univ., Canberra. John Curtin School of Medical Research). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1162 (INIS-mf—6531, pp vp) **Catalase and superoxide dismutase levels in radiation resistant strains of D. melanogaster.** Sutherland, M.W. (Macquarie Univ., North Ryde (Australia). School of Biological Sciences); Westerman, M. (La Trobe Univ., Bundoora (Australia). Dept. of Genetics). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1163 (INIS-mf—6531, pp vp) **Nature of radiation-induced chromosomal interchanges in Drosophila oocytes.** Hilliker, A.J. (Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1164 (INIS-mf—6531, pp vp) **Of what practical value is knowledge of the cell biology and genetics of radiosensitivity.** Harris, A.W. (Walter and Eliza Hall Inst. of Medical Research, Parkville (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1165 (INIS-mf—6531, pp vp) **How real is the environmental mutagenesis threat.** MacPhee, D.G. (La Trobe Univ., Bundoora (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1166 (INIS-mf—6531, pp vp) **Human genetic disorders showing sensitivity to DNA-damaging agents. Strategies for future studies.** Imray, P.; Kidson, C. (Queensland Inst. of Medical Research, Brisbane (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1167 (INIS-mf—6531, pp vp) **In vitro studies of the cellular transport of radioactive caesium-134m in rat thyroid tissue.** Maddalena, D.J.; Boyd, R.E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Isotope Div.); Marsh, C.A. (New South Wales Inst. of Tech., Broadway (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1168 (INIS-mf—6531, pp vp) **Mutagenesis by technetium-99 and by chemicals.** MacPhee, D.G. (La Trobe Univ., Bundoora (Australia)). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1169 (INIS-mf—6531, pp vp) **Cell killing as a function of position of tritiated uridine in the cell.** Panter, H.C. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1170 (INIS-mf—6531, pp vp) **Study of chromosome aberration yield in human lymphocytes as an indicator of radiation dose.** Brown, J.K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1171 (INIS-mf—6531, pp vp) **Carcinogenic and genetic hazards from environmental, medical and industrial radiation sources.** Titterton, E. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1172 **Kinetic perimetry (in the plateau region of the field) as a sensitive indicator of visual fatigue or saturation-like defects in retrobulbar anomalies.** Fitzgerald, C.R.; Enoch, J.M.; Temme, L.A. (Florida Univ., Gainesville (USA). Coll. of Medicine). pp 293-303 of Fourth international visual field symposium. Bristol, April 13-16, 1980. Greve, E.L.; Verriest, G. (eds.). The Hague, Netherlands; Dr. W. Junk (1981).

From 4. international visual field symposium; Bristol, UK (13 Apr 1980).

A series of patients with radiation damage has been studied. Retinal vascular changes shown by fluorescein angiography were accompanied by local alterations in the sustained- and transient-like functions. When no retinal manifestations were found, and in all cases where the optic nerve was involved, visual fatigue or saturation-like effects were noted which were revealed as reductions in sensitivity in time. These could be surprisingly subtle. Because of amplification effects, small reductions in sensitivity in time are readily revealed in the plateau region of the central kinetic field. In every instance these effects, once discovered, could be verified using flashing repeat static tests. Comparable results were obtained in all patients tested.

1173 **Photoproduction in skin of 1α,25-dihydroxyvitamin $D_3$: a novel approach to therapy of vitamin-D-resistant syndromes.** Holick, M.F.; Uskokovic, M.; Adams, J.S.; Henley, J.W.; MacLaughlin, J.; Holick, S.A.; Potts, J.T. Jr. (Hoffmann-La Roche, Inc., Nutley, NJ (USA). Chemical Research Dept.). pp 370 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1174 **Postoperative hypoparathyroidism followed by Parkinsonium.** Imai, Y.; Sakaguchi, K.; Fukami, T.; Tsutsumi, M.; Fukase, M.; Fujita, T. (Kobe Univ. (Japan). School of Medicine). pp 471 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1175 **Stimulation of $^{45}Ca$ release from bone by embryonic chick parathyroid glands in vitro.** Rosen, V.; Clark, N.B. (Connecticut Univ., Storrs (USA)). pp 357 of Hormonal control of calcium metabolism. Proceedings of the 7th international conference on calcium regulating hormones (7th parathyroid conference) held at Estes Park, CO, USA, September 5-9, 1980. Cohn, D.V. (Kansas Univ., Kansas City (USA). Medical Center); Talmage, R.V. (North Carolina Univ., Chapel Hill (USA). School of Medicine); Matthews, J.L. (Baylor Univ., Dallas, TX (USA). Medical Center). Amsterdam, Netherlands; Excerpta Medica (1981).

From International conference on calcium regulating hormones; Estes Park, CO, USA (4 Sep 1980).

1176 **Transcatheter embolization of renal neoplasms. A comparison of the merits of the radio-active infarct implant versus total embolization with inert material.** Lang, E.K.; Pisco, J.M. (Tulane Univ., New Orleans, LA (USA)). pp 230-235 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

Transcatheter embolization with radio-active infarct particles and inert embolic material has been proposed for adjuvant therapy in the management of renal cell carcinoma. Transcatheter embolization with inert embolic material has been advocated in preparation for surgical resection of renal tumours. Embolization with radio-active infarct particles is undertaken to deliver a tumouricidal dose to the primary neoplasm. The resultant interstitial implant offers the advantage of a high dose to the primary tumour, choice of time of delivery of the radiant energy by selection of a radio-isotope with appropriate half-life, and limitation of the integral dose to the patient by selection of appropriate physical characteristics of the radio-isotope utilized. Transcatheter embolization with radio-active infarct particles is advocated either as definitive therapy for clearly inoperable neoplasms, or in hope to make an initially inoperable neoplasm operable.

1177 **Transaxillary intra-arterial treatment of hepatic metastases with cytostatics and embolization: its control by isotope studies.** van Voorthuisen, A.E.; Herben, M.G.; Pauwels, E.K.J. (Rijksuniversiteit Leiden (Netherlands)). pp 242-244 of Intervention radiology. Proceedings of the first international symposium held in Algarve, Portugal, May 29-June 2, 1979. Veiga-Pires, J.A.; Martins da Silva, M.; Oliva, L. Amsterdam, Netherlands; Excerpta Medica (1980).

From 1. international symposium on intervention radiology; Algarve, Portugal (29 May 1979).

Intra-arterial treatment of hepatic metastases has indicated that this is a rewarding procedure and that embolization of the liver has in a few cases resulted in a high remission rate lasting up to one or two years. The distribution of a cytostatic agent can be accurately controlled by isotope studies.

1178 **Gamma-rays and ethylene oxide sterilization. Abstract 226.** Star, E.G. pp 146 of 7th world congress of anaesthesiologists, Hamburg, F.R.G., September 14-21, 1980. Abstracts. Ruegheimer, E.; Wawersik, J.; Zindler, M. (eds.). Amsterdam, Netherlands; Excerpta Medica (1980).

From 7. world congress of anaesthesiologits; Hamburg, F.R. Germany (14 Sep 1980).

1179 **UV radiation effects on molecular and cellular systems. Chapter 3.1.** Lang, H. (Akademie der Wissenschaften der DDR, Jena. Zentralinstitut fuer Mikrobiologie und Experimentelle Therapie). pp 138-167 of Erzeugung, Messung und Anwendung ultravioletter Strahlen. Beier, W. (ed.). Leipzig, Germany; VEB Georg Thieme (1980). (In German)

In this review photochemical processes are discussed which play an important role in the interaction between uv radiation and biopolymers on both the molecular and the cellular level. The repair mechanisms of chromosomal damages as well as the processes of uv radiation-induced mutagenesis and carcinogenesis are outlined. Furthermore the important part of uv radiation in biogenesis, as an ecologic factor, and in photochemical processes in both the troposphere and the stratosphere are pointed out.

1180 **Are we at risk from low-level radiation. DNA repair capacity as a probe of potential damage and recovery.** Riklis, E. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). pp 666-669 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A biochemical method based on measurement of DNA repair capability is described which enables pre-determination of

low level radiation sensitivity. DNA repair was studied by employing the technique of repair synthesis, whereby the amount of incorporation of labelled thymidine ($H^3TdR$) into cellular DNA is measured in cells treated with trioxalen and near UV light which almost totally inhibits the normal semiconservative DNA synthesis. The incorporation of $H^3TdR$ into DNA, following assaults by radiation indicates that repair synthesis is occurring. A linear increase of counts is observed up to a certain radiation dose, this being designated as the repair capacity of the cell. The method is suitable for human fibroblasts, human breast cancer cells, Chinese hamster cells and human lymphocytes. Using human lymphocytes, this method could easily be used for a world-wide interlaboratory comparative study in which the range of 'repair capacity' of normal healthy humans could be established for low level irradiation.

1181 **Main regularities of $^{90}Sr$ migration in mother-fetus biological system. Chapter 5.2.** Borisov, B.K. pp 93-95 of Hobal fallout of nuclear explosion products as a factor of man irradiation. Marei, A.N. (ed.); Barkhudarov, R.M.; Knizhnikov, V.A.; Borisov, B.K.; Petukhova, Eh.V.; Novikova, N.Ya. Moscow, USSR; Atomizdat (1980). (In Russian)

Complex investigations into levels of $^{90}Sr$ administration into the organism of child-bearing women and levels of its buildup in the skeleton of the developing fetus are carried out. Investigations are aimed at finding out quantitative regularities of $^{90}Sr$ transition from mother organism to the fetus during its womb development. Parents of children studied had no contact with ionizing radiation. $^{90}Sr$ content in the bone tissue of the fetus in the period from 4 to 10 moon months is shown to increase ten-fold. $^{90}Sr$ buildup occurs unevenly. $^{90}Sr$ is most actively accumulated in bones at the early stages of pregnancy, as well as in the last month before child bearing. In all parts of the mother-fetus biological chain $^{90}Sr$ is accompanied by its chemical analogue - calcium. Results of calculations using the example of stable strontium show that certain strontium discrimination takes place at earlier pregnancy stages. Strontium and calcium come to the bone tissue of the fetus in the same correlations as they come in mother blood.

1182 **Retention and effects of $^{239}Pu$ in the tree shrew (Tupaia Belangeri).** Seidel, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Genetik und Toxikologie von Spaltstoffen); Darai, G. (Heidelberg Univ. (Germany, F.R.)); Fluegel, R.M.; Komitowski, D. (Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.)). pp 627-630 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The tree shrew (Tupaia Belangeri) is considered to be the most primate-like non-primate. Thus the retention of Pu-239 in tupaias was compared to retention data for other rodents and larger primates in order to evaluate the usefulness of tupaias for toxicological studies. The retention of Pu-239 in four different bones of the tupaia remained constant for up to one year indicating a low rate of bone remodelling. Retention data were also obtained for skeleton, liver, kidneys and spleen for up to 400 days. Initial deposition in kidneys was much higher than in rats but the elimination rates were similar. The initial deposition in skeleton and liver was similar to that in rats. However the half life in tupaia skeleton was somewhat longer. The elimination from tupaia liver was considerably slower than in rats; these results suggest that the retention of plutonium in rat liver is exceptionally short when compared to other animal species, e.g. hamster, dog, primate. Nevertheless the rate of elimination of plutonium from the tupaia liver is still much faster than that predicted for human liver. Little or no biological effects from the Pu-239 injection were observed during the first year.

1183 **Subcellular distribution of $^{239}Pu$ in the liver of rat, mouse, Syrian and Chinese hamster.** Winter, R.; Seidel, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Genetik und Toxikologie von Spaltstoffen). pp 642-645 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

An attempt was made to elucidate the biochemical mechanisms responsible for the species differences in the biological half life of plutonium-239 in the liver of rats, mice, Syrian hamsters and Chinese hamsters. Six days after intravenously administered Pu-239, the animals were given Triton i.p. which causes a shift of the density of the lysosomes and thus any lysosomally-associated material can be recognised by a parallel shift. On the tenth day, an MLP fraction was obtained by differential centrifugation of the liver homogenates; the distribution of radioactivity and marker enzymes was then examined after centrifugation of the MLP fraction in a sucrose density gradient. If the parallelism between the shift of Pu-239 and acid phosphatase is taken as a measure for the extent of lysosomal binding, there is clear evidence for association with these organelles for rats and mice, the species with rapid Pu elimination; however these organelles appear to become less important in the species with longer Pu retention, Syrian and especially Chinese hamster.

1184 **Biological effects of inhaled radionuclides. Summary of ICRP report 31.** Bair, W.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). pp 649-656 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A summary is given of a report prepared by an International Commission on Radiological Protection Task Group charged with determining the biological effects of inhaled plutonium and other radionuclides and evaluating the associated hazards. The biological effects discussed were life-span shortening, haematologic effects, pulmonary nonneoplastic lesions, pulmonary neoplastic lesions and extrapulmonary lesions. The pulmonary and extrapulmonary cells and tissues at risk are also identified. A summary is presented of the risk coefficients for radiation-induced lung cancer following inhalation of radionuclides in animals and man and an Equal Effectiveness Ratio for $\alpha$ emitters relative to $\beta$-$\gamma$ emitters is determined.

1185 **RBE of $\alpha$-particles versus $\beta$-particles in bone sarcoma induction.** Mays, C.W. (Utah Univ., Salt Lake City (USA). Radiobiology Div.); Finkel, M.P. (Argonne National Lab., IL (USA)). pp 661-665 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The bone sarcoma incidence was studied in both beagles and mice following intravenous injections of either $Ra^{226}$ ($\alpha$ emitter) or $Sr^{90}$ ($\beta$ emitter). In beagles, the response seemed approximately linear up to 2500 rads from $Ra^{226}$ but was strongly concave upwards for $Sr^{90}$. In mice, $Ra^{226}$ was more effective than $Sr^{90}$ at low doses but at very high doses the effectiveness converged. The relative biological effectiveness (RBE) of $\alpha$ particles vs. $\beta$ particles in producing bone sarcomas was taken as the ratio of $Sr^{90}$ dose/$Ra^{226}$ dose at a given level of incidence. The RBE progressively increased as the incidence decreased, reaching RBE = 26 at 8.7% incidence in beagles and RBE = 25 at 7.7% incidence in mice. The increase in RBE was largely due to the decreased effectiveness per rad of $Sr^{90}$ $\beta$ radiation at low doses and dose rates.

1186 **Four observations of surgical treatment of wounds contaminated by radionuclides.** Briot, F.; Henry, P.; Lalu, P.; Mercier, J.; Sarbach, J.; Tourte, J. (CEA, 75 - Paris (France)). pp 670-674 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980). (In French)

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Four cases of treating radioactively contaminated wounds received by workers in the Nuclear Industry are described. These injuries were (1) a cut finger acquired through protective gloves while cleaning a glove-box heavily contaminated with $Pu^{239}$; (2) a cut thumb acquired through a pressurized suit while dismantling a $Pu^{239}$ contaminated glove-box; (3) a finger pierced by a metal cable contaminated with fission products and (4) a cut thumb acquired from a $Pu^{239}$ contaminated pipe from a glove-box. From the treatment of these cases, the important points concerning the organization of safety, the therapeutic procedures and the methods for

measuring the levels of radioactivity in the wound and in the body are deduced.

1187 **Radiological consequences of the Three Mile Island accident.** Battist, L.; Peterson, H.T. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Standards Development). pp 677-684 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The radiological consequences of the Three Mile Island (TMI) nuclear accident are discussed in detail. The nature, quantity and timing of the radioactive materials released to the atmosphere are established; mainly radioactive noble gases were emitted. A description is given of the radiological monitoring that occurred and the measured levels both inside and outside the plant are given as a function of time from the accident. In particular, the radioiodine release and its subsequent detection in milk analysis is described. The methods of establishing the population dosage are discussed; it is concluded that the collective dose equivalent is in the range 1600-3300 person rems. This implies a projected cancer (fatal and non-fatal) incidence of less than 1.5 in the offsite population within the 50 miles of the TMI site; the expected occurrence in this population is 541,000 cancers. The exposure of workers to radiation levels within the plant is also reported.

1188 **Approach to the derivation of radionuclide intake limits for members of the public.** Thompson, R.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). pp 657-660 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A systematic approach to the development of radionuclide exposure limits for members of the public is described. The approach starts with the occupational ALI (Annual Limit on Intake) for radiation workers and applies an adjustment factor, separately derived for each radionuclide. Some of the factors that might be involved in the development of values for the radionuclide-specific exposure adjustment factor include a) radiosensitivity factors altering the risk, b) morphological factors altering dose, c) metabolic factors altering retention, distribution and absorption from gastrointestinal tract or lung, d) environmental factors altering biological availability and e) a physical half-life factor. This approach is illustrated by applying it to the derivation of member-of-the-public radionuclide-specific exposure adjustment factors for both Pu-239 ingestion and Pu-239 inhalation. The adjustments required for the ALI for ingestion and inhalation are considered on a lifespan basis and also for the first year of life.

1189 **Two decades of research in the Brazilian areas of high natural radioactivity.** Cullen, T.L.; Paschoa, A.S. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil)); Barcinski, M. (Rio de Janeiro Univ. (Brazil)); Eisenbud, M. (New York Univ., NY (USA). Inst. of Environmental Medicine); Franca, E.P.; Ribeiro, C.C. pp 805-808 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The geology of Brazil results in several areas of high natural radioactivity. The three areas studied were Guarapari, Araxa-Tapira, and Morro do Ferro. In Guarapari, the possibility that internal contamination might arise from inhaled dust or from thoron and radon in the air was studied; however, analysis of placentae showed low values of internal contamination. Nevertheless, a higher rate of chromosomal aberrations in peripheral lymphocytes was observed compared to controls. In Araxa-Tapira, high concentrations of Ra-226 and Ra-228 were found in manioc, flour, potatoes, and citrus fruits. Some inhabitants were shown to have daily intakes of 20 to 40 pCi of Ra-226 and 120 to 240 pCi of Ra-228. On the mountain of Morro do Ferro, measurements of the uptake of Ra-228, Ra-226 and Th-228 by plants ranged from 7 to 10,303 pCi/kg. The concentrations of thoron and radon in rat holes and termite mounds ranged from 5 to 55,400 pCi/l. Since the mountain is estimated to hold 12,000 tons of thorium, the deposit is now being used as an analogue for modelling the transport of plutonium over geological time.

1190 **RA-226 collective dosimetry for surface waters in the uranium mining region of Pocos de Caldas.** Paschoa, A.S.; Sigaud, G.M.; Montenegro, E.C.; Baptista, G.B. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil)). pp 1127-1130 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Dosimetric and environmental models were used to calculate the Annual Collective Dose Equivalent (ACDE) to the population potentially exposed to $^{226}Ra$ from river waters in the vicinity of uranium mining and future facilities in the Pocos de Caldas region. The ACDE for the whole-body, bone, lower large intestine, kidneys and liver via the pathways of drinking water and food grown in irrigated fields are presented as a function of the $^{226}Ra$ concentrations in the surface waters of this region. The results contribute to the understanding of the shortcomings involved in calculating collective dose equivalent due to the potential enhancement of $^{226}Ra$ concentrations in the surface waters near this uranium mining region.

1191 **Para-hydroxybenzoic acid and a hypoxic radiosensitizer in bacterial cells.** Sade, N.; Jacobs, G.P. (Hebrew Univ., Jerusalem (Israel)). pp 1041-1044 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The effects of different concentrations of the electron-affinic compound p-hydroxybenzoic acid (PHBA) on the radiation sensitivity of oxic and anoxic buffered suspensions of Staphylococcus aureus were examined. Increasing concentrations of PHBA from $10^{-6}$ to 5 x $10^{-5}$M in anoxic bacterial suspensions produced no change in the response characteristic of bacteria irradiated with gamma rays in anoxic buffer alone. However, further increases in PHBA concentration to 6 x $10^{-3}$M caused a marked increase in radiation sensitivity, with the maximal response very close to that for suspensions irradiated in the presence of oxygen. The lack of sensitizing action of PHBA in the presence of oxygen suggests that PHBA operates within the $O_2$ effect. The results of the study show that PHBA acts as an efficient hypoxic radiosensitizer when tested against Staphylococcus aureus.

1192 **Radiobiological and radioecological studies with the unicellular marine algae Acetabularia, Batophora and Dunaliella.** Bonotto, S.; Luttke, A.; Strack, S.; Kirchmann, R. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Hoursiangou, D.; Puiseux-Dao, S. (Paris-7 Univ., 75 (France)). pp 1037-1040 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The biological effects of x-rays on the unicellular marine algae Acetabularia mediterranea, Acetabularia peniculus and Batophora oerstedii were studied. Increasing doses of x-rays (0 to 150 kr) were shown to interfere with the main morphogenetic processes of these algae. Labelling experiments with $^{3}H$-thymidine, $^{3}H$-uridine and $^{3}H$-leucine showed that x-rays (50 kr) provoked a strong reduction of DNA, RNA and protein synthesis in the chloroplasts of A. mediterranea. Radioecological studies were also performed showing that Acetabularia cells, grown in the presence of HTO, incorporate a significant amount of $^{3}H$ in the total nucleic acid and protein fraction. However, $^{3}H$ supplied to Acetabularia in the form of tritiated water was not accumulated. When organically bound $^{3}H$ was supplied to Acetabularia or to Dunaliella, a selective accumulation of some substances was observed. Thus the results of this study illustrate the impact of radiation on living organisms and the biological behaviour of $^{3}H$ in the aquatic system.

1193 **Experimental study of cancers induced in the rat by particles with high LET.** Morin, M.E.; Lafuma, J.E. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). pp 1053-1055 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980). (In French)

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The incidence of cancer was studied in rats irradiated with 1 MeV fission neutrons (doses up to 800 rad). The highest incidence of cancer was obtained in the skin and the lungs. The ratio of bone cancers to lung cancers was 0.4; the ratio of the dose absorbed by bone to that absorbed by the lungs is 0.65 for 1 MeV neutrons. These results were compared to the incidence of cancer in rats following inhalation of similar doses of alpha-emitting transuranium elements. The incidence of cancer was the same in the skeleton as in the lungs although the actual dose received by the bone cells was much higher than the lung cells due to the heterogeneous distribution of the radionuclide in the bone in contrast to the homogeneous distribution in the lung. These results suggested that the bone cells might be less radiosensitive than the lung cells to alpha irradiation. However, the results obtained after neutron irradiation did not indicate significant differences in the radiosensitivities of the bone and lung cells.

1194 **Natural background as an indicator of radiation-induced cancer.** Cohen, J.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 801-804 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

A review of the estimates for radiation-induced cancer rates is presented including the recent high estimates of $8 \times 10^{-3}$ cancers/man rem. Also reviewed are the external background radiation and cancer incidence for the USA by state. A regression analysis of these data reveals a negative correlation between radiation dose and cancer rate, but only with a correlation coefficient of 0.39. However, the cancer induction rate of $8 \times 10^{-3}$/man rem is shown to describe the observed data with a probability of 1 in 14,000. Thus, such high estimates of radiation-induced cancer rate are highly improbable.

1195 **Evaluation of cancer incidence for Anglos in the period 1969-1971 in areas of census tracts with measured concentrations of plutonium soil contamination downwind from the Rocky Flats Plant in the Denver standard metropolitan statistical area.** Johnson, C.J. (Colorado Univ., Denver (USA). School of Medicine). pp 809-812 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The incidence of cancer for the period 1969 to 1971 was calculated for Pu isopleth areas of census tracts with decreasing concentration of Pu in the soil contaminated by the Rocky Flats Pu-processing plant. Compared to males in the unexposed area, there was an incidence of cancer 8% higher for males in Area III, most distant from the plant, 15% higher in Area II, nearer the plant, and 24% higher in Area I, nearest the plant. The corresponding values for females were 4%, 5% and 10%, and for both, 6%, 10% and 16%. Results were also presented for the cancer incidence in various parts of the body for each sex in the exposed population compared to the unexposed population. The consistency of the increase in incidence of all cancer and of certain categories of cancer with increasing concentrations of Pu in soil supports the hypothesis that exposure of the general public to low concentrations of Pu in the environment may have an effect on cancer incidence.

1196 **Assessment of biological effects resulting from large scale applications of coal power plant wastes in building technology in Poland.** Pensko, J.; Geisler, J. (Institute of Nuclear Research, Warsaw (Poland)). pp 821-824 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

An evaluation is performed of the radiation-induced biological effects on the population of Poland with the use of coal power plant wastes for the production of building materials. The assessments of the risks indicated that the use of these materials increased the risk of death from neoplasms and genetic diseases. In the considered period, 1951-2010, the number of leukemias are expected to increase more than twice, the number of malignant neoplasms nearly three times and the number of lung cancers nearly five times. In the same period, only a relatively small increase of about 13% should be observed in the serious genetic defects from the same cause. Comparison of the somatic effects of the excess indoor irradiation with the death rate of neoplasms from all causes revealed the relatively high contribution of the indoor irradiation in the overall incidence of neoplasms.

1197 **Combined carcinogenic effects of ionizing radiation and chemical molecules.** Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). pp 973-980 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980). (In French)

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Studies of the combined effects of ionizing radiation and chemicals on the incidence of cancer are briefly reviewed. Results (mainly animal data) are presented for the combined effects of: (1) x-radiation and urethane on the incidence of leukaemia and lymphomas; (2) x-radiation and N-N'-2,7 fluorenylenebisacetamide, x-radiation and carbon tetrachloride, neutron radiation and carbon tetrachloride and cerium-144 and DAB on the incidence of cancer of the liver; (3) $^{131}I$ and methylthiouracil on the incidence of thyroid cancer; and (4) inhaled radon and cigarette smoking, inhaled plutonium and beryllium oxide, inhaled plutonium oxide and benzopyrene, inhaled plutonium and dimethylnitrosamine, and inhaled radon and 5 to 6 benzoflavone on the incidence of lung cancer. Many of the studies showed that the combined effects of radiation and chemicals had a potentiating effect on tumor formation; there was often a shortening of the latency period before tumor induction and an increase in the size and the malignancy of the tumor. The mechanism of action of these combined effects on tumor incidence are considered.

1198 **Chemical protection and sensitization to ionizing radiation molecular investigations.** Badiello, R. (Consiglio Nazionale delle Ricerche, Bologna (Italy). Lab. di Fotochimica e Radiazioni d'Alta Energia). pp 1025-1028 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The main classes of radioprotective and radiosensitive drugs include compounds with respectively reducing and oxidizing properties toward the radiation induced radicals derived from biological materials. Some significant examples of the application of radiation chemistry to chemical radioprotection and radiosensitization are illustrated. Specifically, the mechanisms of radioprotection offered by -SH compounds are discussed as are the mechanisms of radiosensitization produced by strongly electronaffinic compounds. The results demonstrated the important role played by molecular phenomena for the interpretation of mechanisms of chemical radioprotection and radiosensitization and for the development of more active substances. Much of the information concerning the involvement of fast processes in chemical radioprotection and radiosensitization is derived from studies of simple model chemical and cellular systems carried out with fast radiation chemical techniques.

1199 **Sustained release of radioprotective agents in vitro.** Shani, J.; Benita, S.; Samuni, A.; Donbrow, M. (Hebrew Univ., Jerusalem (Israel). Hadassah Medical School). pp 1060-1063 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

An in vitro study of the release of the radioprotective agents cysteine and cysteamine from their tablet matrices was performed.

A significant decrease in the rate of 20% cysteine release from the tablets was observed with increasing stearic acid concentration in the stearic acid/ethylcellulose matrix mixture. The release rate of cysteamine also decreased with increasing stearic acid concentration in the matrix. In general, the release rate of 20% cysteamine from similar matrix mixtures was much higher than that of cysteine. Preliminary findings suggested that, with 20% cysteamine, higher pressures applied to the tablet during its formation result in a quicker drug release; however, with 20% cysteine no such irregularity was noticed.

1200 **Analytical approach to the comparison of chemical and radiation hazards to man.** Leenhouts, H.P.; Chadwick, K.H.; Cebulska-Wasilewska, A. (Association Euratom-ITAL, Wageningen (Netherlands)). pp 1155-1158 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

An analytical model, based on radiation biological concepts at the molecular level, is presented which permits an analysis of the effects of other agents and also predicts that a synergistic interaction between two different mutagenic agents can occur at the molecular level. Data analyzed by this model are presented for (1) the survival of Chinese hamster cells after combined treatment of x-rays and UVR; (2) the survival and chromosomal aberrations induced by radiation in synchronized Chinese hamster cells with and without BUdR; and (3) the induction of pink mutations in Tradescantia stamen hairs by x-rays and ethyl methane sulphonate (EMS) and the contribution of mutations arising from the interaction between the EMS and the x-rays as a function of the product of chemical exposure and radiation dose. The analysis showed that the synergistic interaction occurs at the molecular level in the DNA. The synergism was demonstrated in cell survival, chromosomal aberrations, and somatic mutations and can therefore be expected for cancer and hereditary defects.

1201 **Inhalation of radon and its daughter products. Doses and pathological effects.** Mechali, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). pp 957-964 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980). (In French)

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

The inhalation and pathological effects of radon and its daughter products in man are briefly reviewed. The first section deals with the formation of daughter products from radon, their physical form, the lack of equilibrium between the daughter products and radon in the atmosphere and the nature of the radiation emitted by the various daughter products in relation to the exposure of the respiratory tract. The second section reviews the models which have been used to evaluate the radiation doses received by the different regions of the respiratory tract as a function of the activity of the daughter products inhaled in either the free form or bound to particles in the air. The final section examines the pathological effects resulting from the inhalation of radon daughter products. In particular, the incidence of pulmonary cancer in uranium miners in two epidemiological studies, one in the USA and the other in Czechoslovakia, was compared.

1202 **Dynamics of Cs-137 distribution in the muscle tissue of swine by single and repeated contamination.** Begovic, J.; Stankovic, S.; Mitrovic, R. (Institut za Primeni Nuklearne Energije u Poljoprivedri, Veterinarstvu i Sumarstvu, Zemun (Yugoslavia)). pp 1029-1032 of Radiation protection. A systematic approach to safety. Oxford, England; Pergamon Press (1980).

From 5. international congress of the International Radiation Protection Association; Jerusalem, Israel (8 Mar 1980).

Following both single and repeated oral doses of cesium-137 to pigs, the levels of cesium-137 were measured in muscle tissue and the cumulative urinary and faecal excretion determined. Muscle tissue was examined in particular owing to its use in human nutrition. The difference in the levels of Cs-137 in individual muscles following both single and repeated doses were insignificant. The radioactivity in all the muscles decreased exponentially with time, the greatest decrease occurring in the first 14 days after administration. The levels of Cs-137 in individual muscles almost doubled when the single oral dose was doubled. The effective half-time of excretion of Cs-137 following repeated administration was between 17 to 20 days; however following the single dose, the effective half-time was 5 days.

1203 **Seventh world congress of anaesthesiologists.** Ruegheimer, E.; Wawersik, J.; Zindler, M. (eds.). Amsterdam, Netherlands; Excerpta Medica (1980). vp. (CONF-8009210—(Absts.)).

From 7. world congress of anaesthesiologits; Hamburg, F.R. Germany (14 Sep 1980).

Separate abstracts have been prepared for individual items within scope for inclusion in the Energy Data Base.

1204 **Repair and actio spectrum of oxygen-independent lethality of near uv light on Haemophilus influenzae and lack of mutation.** Cabrera-Juarez, E.; Setlow, J.K. (Brookhaven National Lab., Upton, NY). *Mutation Research;* 72: 49-55(1980).

Haemophilus influenzae has been inactivated anaerobically at 313, 334, 365, and 405 nm, and exhibits the greatest sensitivity at 334 nm. The rec1 and uvr1 mutants show the greatest increase in sensitivity over the wild-type at 313 nm, but differences could be seen also at the other wavelengths. Anaerobic irradiation is less effective for killing at all the wavelengths than irradiation under aerobic conditions, but the greatest difference was observed at 365 nm. No induced mutation was seen as a result of anaerobic irradiation at 334 nm, although purified transforming DNA can be mutated at this wavelength.

1205 **Relation of mucoprotein metabolism with radiosensitivity of rat organism exposed to ultraviolet radiation.** Mamotyuk, E.M.; Kornienko, V.V. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 16-20 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

It is established that the protective effect of small UV doses in rats against ionizing radiation reveals itself only during repeated (not less than 4) UV radiation. A shorter period of UV radiation in the same integral doses burdens the subsequent effect of ionizing irradiation. The relation of mucoprotein metabolism indexes with the change in the rat organism radiosensitivity has been discovered, a possible mechanism of changes being observed is discussed.

1206 **Fractional composition of sulfurmucoids in rats at acute radiation sickness.** Lukashova, O.P. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 21-25 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Quantitative determination of separate sulfurmucoid (SM) fractions in rats in the acute radiation sickness has been carried out. A phase increase in a total SM content and their separate fractions is shown. It is established that the most reactive are the second, third, and fourth fractions, a greater growth of the level of each of the above fractions corresponding to a more severe progress of the sickness. This property can be used when developing criteria of radiation injury seriousness.

1207 **Study on bone tissue diffraction picture of irradiated rats of different age.** Fenkel', L.A.; Tkachenko, V.F.; Dun, D.L.; Smushkov, I.V. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 13-16 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Peculiarities of post-irradiation disturbances of a crystal structure of a mineral phase of animal bone tissues have been studied by the X-ray structural analysis. It is established that under the effect of ionizing radiation in a diffraction picture of bone minerals significant disturbances occur, the degree and character of which depend on animal age and dynamics of radiation injury. Molecular-structural disturbances detected in the mineral phase promote the understanding of the mechanisms of post-irradiation changes in the process of mineralizing and reducing the buffer efficiency of bone

deposits under conditions of organism radiation injury in different ages.

1208 **Study on fractional composition of serous and tissue mucoproteins in rats in norm and at acute radiation sickness.** Mamotyuk, E.M.; Lukashova, O.P.; Tereshchenko, L.P.; Piskareva, E.V. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 25-29 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Study of fractional composition of mucoproteins in tissues of different rat organs has shown that the hepatomucoid composition is the closest to sulfurmucoids in norm. For all the tissues the presence of a certain quantity (15-30%) of a lowmolecular component presenting in tissues in a readily soluble form as well as in a stronger bound form has been established. In the radiation sickness in rats in hepatomucoids a content of highmolecular fractions decreases and a lowmolecular fraction content comparatively enhances, the dynamics of the change in the fraction content reflecting peculiarities of the progress of the sickness.

1209 **Operative intervention effect on hematopoietic state in irradiated rats.** Simonova, L.I.; Samuleva, S.V.; Lakiza, L.V. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 31-33 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Results of dynamic investigation into the peripherical blood of white rats subjected to femur fracture after 750 R irradiation are presented. It is established that another trauma significantly affects the general picture of peripherical blood injury, the main syndrome of which is a radiation leukopeniya with a primary depression of lymphopoiesis.

1210 **Morphological and biochemical changes in genesis of postradiation interphase cell killing.** Samuleva, S.V.; Tkachenko, G.I.; Simonova, L.I.; Nipko, S.E. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 41-44 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Considerable changes in the total number and viability of thymus, spleen and bone marrow cells of animals have been determined during investigations carried on after 1-9 and 24h after 600R irradiation of rats. It is found that mass cell killing of erythroid and lymphoid raws occurs in bone marrow and spleen. Simultaneously, DNA synthesis and nuclear proteins depression is observed. Changes in liver are expressed insignificantly as compared to the norm.

1211 **Molecular and endocrine mechanisms of postradiation changes in reactivity of bone tissues.** Shantyr', V.I.; Frenkel', L.A.; Mikhajlov, P.A.; Yakovenko, M.G. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 7-12 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

The state of the production system of the specific hormone factor calcitonin as well as metabolism and physicochemical properties of collagenous matrix of bone tissue in irradiated rats of different ages was studied. It is established that under 400 rad total X-ray irradiation there are the following considerable disturbances in albuminous matrix of bone tissue changes of the intensity of catabolic and anabolic processes as well as structural-molecular organization of collagen and its ripening. The degree and character of these disturbances depend on the age of irradiated animals and dynamics of radiation injury. Under ionizing radiation of a sublethal dose compensatory-adaptive reactions develop on the level of the hormonal control of bone metabolism for the conservation of the buffer homeostatic function of the bone system in maintaining calcium homeostasis. These mechanisms are disturbed most at the preadolescent age.

1212 **Some changes in ultrastructure of bone marrow cells in its aplastic states.** Piskareva, E.V.; Markov, V.I.; Kononeko, E.K. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 114-117 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Ultrastructure of bone marrow cells in persons with hematopoietic depression as a result of systems diseases and professional or medical factors has been studied. It is established that degenerative changes are characteristic of myeloleukemia predominantly in slightly differentiated cells of myeloid sprout. In patients with moderate leykopenia and hypoplastic anemia, which were subjected to the radiation factor by force of their profession, the ultrastructure of erythroid cells predominantly suffers at a later stage of their evolution. Degenerative changes in the cells of the yeloid row of bone marrow in patients with cancer, subjected to radiotherapy only or in combination with chemotherapy, are greater during a more intensive medical effect.

1213 **Child-bearing function in women with ionizing radiation.** Vusik, I.M.; Kogan, I.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 120-122 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Study on a generating function in 393 women working in the sphere of ionizing radiation effect has shown that when working without exceeding the permissible irradiation level of 5 rem/year, some strengthening of this function is observed while working, with a considerable excess of permissible irradiation doses at the reproductive age, the decrease of childbirth and the increase in the number of miscarriages and premature birth are noted. The increase of girl childbirth as compared with boy childbirth is proportional to radiation load during the work with radiation sources. The secondary sterility appears in the same number of women exposed to the occupational irradiation and women of a control group.

1214 **Dynamics of radiocardiographic indices in radiation treatment of patients with mammary gland cancer.** Ivanitskaya, V.I.; Kurkchi, N.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 64-67 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, USSR; Zdorov'ya (1979). (In Russian)

Forty patients with the 2 and 3 stage mammary cancer have been examined by radiocardiography before and after radiotherapy at the GUT-Co-400 M, "Rocus-M", and RUM-17 facilities. After the treatment revealed were the deceleration of blood circulation in cardiac cavity in 42.5% patients, of greater circulation in 85.0% patients, the decrease of the ejection coefficient from both ventricles of the heart in 87.5%, flattening of RCG pieces in 85.3% patients and appearance of single-humped curves 56.1% which points to the reduction of contractile ability of myocardium and vascular tension.

1215 **Nature of cell composition of spleen in cancer of different localization after radiotherapy.** Mel'nikova, S.M.; Sadchikov, V.D.; Yushchenko, L.P.; Mikhailov, P.A. (Khar'kovskij Meditsinskij Inst. (Ukrainian SSR); Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 111-114 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

Histomorphological investigations of spleen in 74 patients with cancer of different localization, some part of which was exposed to radiotherapy and was given chemotherapeutic preparations, have shown that radio- and chemotherapy result in considerable changes of tumor cells.

1216 **Immediate and delayed radiation reaction of stomach in patients with cervix uteri carcinoma in combined radiotherapy.** Zhidovtseva, M.I.; Dynnik, M.S.; Braunshtein, M.G.; Busygina, N.A.; Lugovskaya, K.A.; Skul'skaya, M.I. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 100-106 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

The results of studying clinical-functional changes of stomach in 110 patients have shown that the combined radiotherapy re-

sults in direct stomach reactions predominantly in the form of functional disturbances with the decrease of secretory and fermentation functions, in the decrease of gastromucoproteids and nitrogen substances in gastrie juice. Dependence of a character and frequency of these changes on an absorbed dose and radiation type has not been established except for a more pronounced depressive effect of external X-ray therapy on the secretory function of stomach. The above clinical and functional disturbances rehabilitate themselves during 1-2 years after the treatment.

1217 **Functional state of adrenal glands of patients with endometrium cancer before and after radiotherapy.** Kogan, I.A.; Gerbst, A.V.; Kislichenko, V.A.; Avraimova, M.T.; Fain, E.A.; Lokhvitskaya, M.V.; Skripnik, L.D. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 93-100 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

Examination of 56 patients has shown that during the combined treatment an operation and radiotherapy decrease corticosteroid content, during the combined radiotherapy the content of these hormones increases and till the end of the treatment course the quantity of biologically active F and B fractions in blood plasma reduces. In patients with endometrium cancer observed are the deterioration of the functional state of adrenal cortex, the disturbance of metabolism of hormones under study, hormonal-mediatory dissociation of the sympath-adrenal system with the activation of the adrenal link, the decrease in available and potential resources of adrenal cortex as well as in sensitivity of hypothalaAus to physiological stimulator - insulin.

1218 **Hemodynamic changes in patients with cervix uteri carcinoma in the process of combined radiotherapy according to the data of arterial oscillography.** Pavlova, T.D. (Ukrainskij Inst. Usovershenstvovaniya Vrachej (Ukrainian SSR)). pp 78-83 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

Results of examination of 152 patients with cervix uteri carcinoma of 1 and 2 stages in the process of combined radiotherapy are presented. Significant changes in oscillographic indices under the effect of different types and doses of ionizing radiations as well as post irradiation periods have been revealed. The most strenuous stages of radiotherapy turned out to be intracavitary curietherapy. At that, for the first time after withdrawal of a radioactive preparation there are the considerable deterioration of contractile ability of myocardium and compensatory increase in the peripherical arteries tone. Oscillogram in the form of a straight line obtained for a number of patients points to the deterioration of protection adaptation mechanisms of cardiovascular activity requiring the corresponding correction.

1219 **Analysis of chromosomal aberrations of leukocytes of peripheric blood in patients with depression of different genesis hematopoiesis.** Samsonova, L.A.; Shurupova, E.N.; Burshtein, Sh.A.; Dynnik, M.S.; Gaisenyuk, L.A.; Romanova, I.N. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 33-36 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

Cytogenic investigations were carried on to reveal the increase in the aberration cell content as compared to the spontaneous level in 30 patients. The least quantity of the cells were in patients exposed to radiotherapy (6-14%), the greatest - in patients subjected to the combined treatment (radio- and chemotherapies). All the patients had structural changes in chromosomes and the primary type of aberrations was a chromosomal one. The group of patients subjected to chemotherapy before leukopenia had aberrations of the chromatid type (16.4%). It is concluded that leukopenias result from structural and quantitative changes in the chromosomal apparatus of leukocytes in patients under the effect of mutagenous factors on the organism.

1220 **Autosensibilization of organism in different pathologic states and radiotherapy of oncologic patients.** Yasinova, A.A.; Dubik, V.T.; Pashchenko, N.S.; Gol'tyapina, I.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR); Khar'kovskij Inst. Usovershenstvovaniya Vrachej (Ukrainian SSR)). pp 75-78 of Ehksperimental'naya i klinicheskaya radiologiya. Kiev, Ukrainian SSR; Zdorov'ya (1979). (In Russian)

A certain relation has been found between the state of patients and the number of autohemolysins in peripherical blod when studying autohemolysins in persons With acute myocardial infarction, pneumonia and in oncologic patients exposed to radiotherapy. Persons weakened by the progress of myocardial infarction had the highest titers of autohemolysins. The sharp jump-like increase in autohemolysins quantity testifying to a high degree of autosensibilization always preceded the relapse of infarction and pneumonia. High indexes of autohemolysins in oncologic patients exposed to radiotherapy in most cases were also determined against a background of marked autosensibilization (cutaneous breaking out, cutaneous itch, general asthenia). The data obtained confirm nonspecificity of autohemolisis reaction, its relation with autoagressive processes.

1221 **Advance in radiation protection monitoring. Proceedings of an international symposium held by the IAEA in Stockholm, Sweden, June 26-30, 1978.** Vienna; IAEA (1979). vp. (CONF-780612—).

From Symposium on advances in radiation protection monitoring; Stockholm, Sweden (26 Jun 1978).

Separate abstracts were prepared for individual papers in these proceedings. (ERB)

1222 **RNA biosynthesis in rabbit skeletal muscles in case of combined radiation injury.** Blokh, K.O.; Nagulin, Yu.A.; Fedorova, L.I.; Andrusenko, V.V. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 3-5 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

The effect of combined radiation injuries (CRI) on RNA-10 deg and $RNA_{10}+65=$deg fraction biosynthesis in skeletal muscles has been studied. Experiments were carried out on rabbits with lacerated-crushed wounds of femur muscles against a background of acute radiation sickness ($LD_50/30$) at 655 rad absorbed dose. The investigations were carried on in 3, 7, 12, 21 and 30 days after surgical therapy of wounds started in 24 h after CRI. It is established on the base of $^{14}C$ orotic acid inclusion in RNA that a sharp strirring up of synthesis of RNA fractions under investigation with a relative normalization only to the 30-th day is characteristic of the traumatized muscle under conditions of the radiation sickness. RNA synthesis in nontraumatized muscle for most periods of the investigation does not differ from a control.

1223 **Structural and functional change peculiarities in immunocompetent organs during radiation injury in animals treated with αZ-macroglobulin.** Mikhajlov, P.A.; Simonova, L.I.; Sadchikov, V.D.; Krivonosov, M.V.; Gnedushkin, Yu.N. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 26-32 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

An investigation has shown that in 3 and 7 days after irradiation in animals both treated with alpha$_2$-macroglobulin ($\alpha_2$-mg) and nontreated a sharp depression of immunomorphological reactions in thymus, spleen and lymph nodes is noted. Beginning from the 14-th day after irradiation, considerable morphological recovery of organs under investigation starts however the immunomorphological reaction was more pronounced in rats intaken $\alpha_2$-mg. Earlier and complete recovery of the structure and function of immunocompetent organs in rats treated with $\alpha_2$-mg has been revealed on the base of morphological and histochemical analyses.

1224 **Serum-mucoid fraction content in development of skin acute radiation necrosis in rats.** Lukashova, O.P. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 15-19 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Serum-mucoid fraction composition (in polyacrilamide gel) in rats during the different stages of local acute radiation injury of skin (6000 rad irradiation) has been studied. For this injury type during all the periods no appearance of new, unusual for the norm, fractions of serum-mucoids is noted. 2 stages of changes in serum-mucoid fractions have been revealed: the simultaneous increase in the content of all the serum-mucoid components is observed during acute period (bullous dermatitis); during a necrotic period of development of acute skin radiation injury the level of the third fraction increases, the number of the first fraction decreases, the content of the second and forth fractions changes slightly. The level of total serum-mucoids is predominantly determined by the changes of the third fraction, growth of which during the ulcer-necrotic period depends clearly on an injury degree. The determination of the third fraction containing, likely, low molecular haptoglobin in these cases can be of prognostic and diagnostic values.

1225 **Metabolism breakage of non-collagenous proteins and skin ultrastructure of rats in case of its local radiation acute injury.** Mamotyuk, E.M.; Piskareva, E.V.; Shantyr', V.I.; Lukashova, O.P.; Markov, V.I.; Tereshenko, L.P. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 10-15 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Changes in histologic structure and ultrastructure of conjunctive tissue as well as the content of non-collagenous proteins (mucoproteins and structural hypoprotein) in rat skin in its acute radiation in ury leading to the ulcer development were studied. Noted are marked disturbances of ultrastructure of various skin layers (cells and collagenous fibers) leaving behind in its development the changes detected by histologic methods and correlating with the content of collagenous proteins. The calculation of the protein ratio promotes the determination of the process trend in an injured skin section. A systematic character of injury resulting in the development of protective reaction in nonirradiated skin during the initial period and weakening of its functional properties during the period of radiation necrosis formation has been revealed.

1226 **Peculiarities of stomach injury healing in dogs irradiated with 350 R and non-irradiated.** Sukhorukov, B.Z.; Terent'ev, G.V.; Kostyuk, G.Ya. (Vinnitskij Meditsinskij Inst. (Ukrainian SSR)). pp 47-51 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

The healing of a stomach wound after the section has been studied in 42 dogs: in 16 nonirradiated and in 26 dogs irradiated at 350 R dose and operated in three days after the irradiation. The stomach wound was sewn with a two-raw sew. To carry on the microscopic investigation of a stomach wall near the wound the animals were killed in 12h and 1,3,6,9,15,21,27 days after the operation. The dogs satisfactorily bear narcosis and gastrotomy during a occult period of radiation sickness though during a fortnight they were flabby and had the decreased meal excitability. In nonirradiated dogs these phenomena were observed up to 3 days. The stomach section zone in dogs of a control group in 6 days is already represented with a new conjunctive tissue and is covered with cylindrical epithelium; the irradiated dogs had the same changes only in 9-15 days after gastrotomy.

1227 **Effect of complex preparations on C and P vitamins on the chromosomal aberration formation in hepatocytes of the irradiated rats.** Naumova, G.M.; Rudakov, N.P. (AN Ukrainskoj SSR, Kiev. Inst. Problem Onkologii). pp 39-42 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

It is shown in experiments on 200 male rats which were subjected to the whole-body irradiation at 500 R dose that the number of aberrant mitroses in liver cells decreases during a month from 63.6 to 56.1%. Preradiation administration of galascorbin and ascopola - a complex preparation of aqueous oats extract with ascorbic acid - results in the considerable decrease in the number of injured cells in 2 days and in 28 days - up to 31%. It is suggested that an earlier decrease in the number of injured cells is due to the reparation processes, and a later one results from injured cell elimination.

1228 **Changes in morphological and cytochemical indices of peripheral blood in white rats following combined effect of permanent magnetic field and ionizing radiation.** Shust, I.V.; Kostinik, I.M.; Stasyuk, G.A. (Ternopol'skij Pedagogicheskij Inst. (Ukrainian SSR)). pp 35-39 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

In 30 white rats the morphological composition of blood and cytochemical changes in leukocytes at an initial period of acute radiation sickness resulted from ionizing radiation and the effect of a strong magnetic field (SMF) have been studied. It is revealed that the preliminary effect of SMF during radiation injury decreases leukopenia and promotes accelerated recovery of leukocytes (as compared to animals sub ected to only X-ray irradiation). A considerable decrease of some cytochemical indices of blood is noted.

1229 **Some peculiarities of ultrastructural changes of bone marrow myeloid and erythroid sprouts of rats in acute radiation injury.** Markov, V.I.; Piskareva, E.V.; Mamotyuk, E.M. pp 20-26 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Changes in rat bone marrow tissue in 3,7,14,21 and 28 days after 750 R irradiation have been studied by electron microscopy. Deep injuries in ultrastructure of cells of myeloid and erythroid sprouts of bone marrow have been established. A more intensive macrophage reaction leading to the bone marrow cleaning from destructing cells results from the reconstruction of reticular cells. Myeloid cells are destructed due to their ultrastructures disintegration, while erythroid cells - due to pyknosis. Maximum injury of erythroid sprout cells is noted during the period of the most pronounced recovery in a myeloid sprout. These regularities point to the necessity of special measures to stimulate red hematopoiesis during the period of its greatest injury.

1230 **Ionizing radiation effect on calcitonin production system in rats of various ages.** Frankel', L.A.; Mikhajlov, P.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 5-10 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

The content of C cells in thyroid and thymus in 150 Vis-tar male rats was studied in the dynamics of acute radiation injury resulted from the whole-body X-ray irradiation at 800 rad lethal dose. In norm the C cells are detected in rats both in thyroid and thymus. Young animals (1-3 months) had the maximum number of C cells in thymus, aged animals - in thyroid. Age differences in calcitonin production are related to the level of metabolic activity of bone tissue at different stages of ontogenesis and are one of the factors stipulating the reduction of the ion exchange homeostatical function of bone in the ageing of the organism. The age differences in the system state producing caltcitonin are revealed in a character of postirradiation injuries of compensatory bone mineralization during the radiation injury.

1231 **Estrogen excretion in woman working for a long period of time with ionizing radiation sources.** Kogan, I.A.; Vusik, I.M. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 128-131 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Depending on the total radiation load the estrogen function of ovaries in 44 women working on former occasions with X-ray

and gamma sources with exceeding maximum permissible level of occupational irradiation at present has been studied. It is shown that in women at a total radiation load of 70-150 rem the elongation of the follicle phase of menstrual cycle (the fifth - the seventh day) is observed and the estrogen excretion is at a hight of the lutein peak. In women working under extremely unfarvourable conditions (integral doses of 150-400 rem), estrogen excretion insignificantly differs from analogous indices at a lower radiation load (70-150 rem) which attributes to protective - adaptive reactions of an organism in response to the long-term effect of radiation factor.

1232 **Radioactive sulphur metabolism in rat organism in the early stages of dental caries.** Genesina, T.I.; Dmitriev, I.M.; Fedorov, Yu.A.; Chopovskaya, T.I. (Odesskij Nauchno-Issledovatel'skij Inst. Stomatologii (Ukrainian SSR)). pp 94-96 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Metabolism disturbances in animal organs have been investigated at early stages of experimental dental caries by means of radioactive $^{35}S$ injected in the form of sodium sulfate. Changes in sulfate metabolism were detected directly not only in solid dental tissues but in the whole organism of animals.

1233 **Neoplasm appearance resulting from chronic intake of mixtures of radium-226, strontium 90, ddt.** Mukhin, I.E.; Borovikova, N.M.; Cvatkov, V.I.; Nagovitsina, L.I.; Prishepin, L.V. (Kievskij Nauchno-Issledovatel'skij Inst. Obshchej i Kommunal'noj Gigieny (Ukrainian SSR)). pp 43-47 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Dependence of neoplasm appearance on a radionuclide type and a form of accountancy of organism response is elucidated which determines the identification of a type of a combined effect of factors on an organism. It is shown that the combined chronic intake of $^{90}Sr$ and $^{226}Ra$ results in pronounced increase in neoplasm appearance with the presence of DDT in the organism. A method for estimating the results of the combined effect of harmful agents on the organism is suggested.

1234 **Radiation hygiene working conditions and health state of the personnel dealing with sealed radioactive materials.** Dynnik, M.S.; Romanova, I.N.; Gajsenyuk, L.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)) (and others). pp 121-128 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

Radiation hygiene conditions of work for persons dealing with sealed $^{60}Co$, $^{226}Ra$ and polonium-beryllium sources, the health state of 146 industrial and medical radiologists as well as 67 persons of a control group have been studied at 3 objects. A set of dosimetric, radiometric, clinical, electrophysiological immunologic, hormonal and statistic methods has been used. It is established that annual loads of medical personnel do not exceed a maximum permissible dose and vary from 0.04 to 24 rem, those for personnel dealing with radioactive logging amount to 0.15-0.2 rem, i.e. lower 25 and more times as compared to MPD. The functional state of cardiovascular and nervous systems, motor and fermentation function of stomach, sexual sphere of women-radiologists as well as peripherical blood composition does not differ from the corresponding indication in the control group and remain within the limits of physiological variations.

1235 **Dynamics of hematologic indices in patients with breast cancer in megavolt gamma therapy.** Duma, V.A.; Ivanitskaya, V.I.; Burshtein, Sh.A.; Gerinshtein, I.G. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 102-106 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, USSR; Zdorov'ya (1978). (In Russian)

An analysis of the change in morphological composition of peripherical blood and medullary hemopoiesis from the data of radioisotopic investigation by means of $^{59}Fe$ in 58 patients with breast cancer of 2 and 3 stages exposed to telegammatherapy at a "ROCUS" installation (113.6 R/min dose rate) is presented. Leukopenia and lymphopenia were detected in 43.3% of patients, which were more pronounced during the macrofractionation and independent course of radiotherapy. Ferrokinetic investigations revealed depression of medullar erythropoiesis activity: 2 time decrease of erythropoiesis index, reduction of iron utilization coefficient with erythrocytes, plasma and erythrocytic iron metabolism decrease of circulating blood volume on account of decrease of circulating erythrocyte=mass=in peripherical blood. The results obtained testify to the necessity of the complex study on the functional state of hematopoiesis (morphological composition of peripherical blood and ferrokinetic investigations) during and after radiotherapy for timely hemostimulating treatment.

1236 **Comparative evaluation of treatment of patients with syringomyelia with X-rays and radioactive iodine.** Shul'ga, A.I.; Gurkina, K.I.; Sidora, V.D. (Poltavskij Meditsinskij Stomatologicheskij Inst. (Ukrainian SSR)). pp 108-110 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

It has been established during the examination of 72 patients (39 males and 33 females of 20-60 years old) with various clinical forms and remoteness of syringomyelia that there is an injury of cervical enlargement of the spinal cord in 69(92+-2%) patients including the cases of the injury spreading on medulla oblongata in 23(33+-6%) patients. 47 patients were exposed to deep X-ray therapy, 25 patients were treated with radioactive iodine. Simultaneously, all the patients were intaken group B vitamins, dibasol, nicotinic acid, neostigmine methylsulfate, pentaxyl and leukogen. A comparative analogy of the therapeutic effect of both types of comprehensive treatment (decrease of objective and subjective disturbances of sensitivity, trophic and motor disturbances) has been determined. However, the radioactive iodine treatment was more preferable which is easier born both during repeated courses and by weak patients as well as does not cause complications in the form of leykopenia, which is met more often when applying the deep X-ray therapy.

1237 **Experiment on radiotherapy of postnatal mastitis.** Zhut'ko, A.A. (Donetskij Meditsinskij Inst. (Ukrainian SSR)). pp 118-121 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

The results of radiotherapy of postnatal mastitis in 78 women are presented. It is shown that the radiotherapy is the method of choice. Application of radiotherapy at different stages of disease promotes either complete resolution of infiltration (1-2 irradiations) or stipulates the decrease in temperature, abatement of pains and improvement of general state (at the presence of purulent fusion of mammary tissue). X-ray therapy of postnatal mastitis has does not affect the lactational function of mammary gland.

1238 **X-ray therapy of calcaneal spur.** Beletskii, V.I.; Efimova, A.S.; Baikova, V.P.; Zhut'ko, A.A. (Donetskij Meditsinskij Inst. (Ukrainian SSR)). pp 116-118 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

Data on the efficiency of X-ray therapy of patients in pains resulted from so called, calcaneal spurs are given. The results of the treatment of 2 patient groups exposed to different single and integral doses have shown the expediency of applying lower doses.

1239 **Formation of autohemolysins in radiotherapy of oncologic patients.** Pashenko, N.S.; Ivanitskaya, V.I.; Gerinshtein, I.G.; Kislichenko, V.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 97-101 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

Formation of autohemolysins before and after radiotherapy in 51 patients with mammary gland cancer and 70 patients with cervix uteri carcinoma has been studied. Telegammatherapy of different dose rates has been used: "ROCUS" installation - 113.6 R/

min, GUT-Co-400M-19.1 R/min. Besides the patients were subjected to X-ray therapy at 59.2 R/min dose rate at a RUM-17 installation. In 33 patients with mammary gland cancer and 47 patients with cervix utery carcinoma after the above radiotherapy the number of plaque-forming cells has increased as compared with the initial data. The reaction for detecting plaque-forming cells in blood of oncologic patients in the dynamics of radiotherapy can be recommended as a test determining the organism response to radiation effect. The appearance of the large number of autohemolysins at a certain stage of radiotherapy can be an indication for patient prescription of drugs reducing its organism autosensibilization.

1240 **State of motor function of stomach in patients with cervix uteri carcinoma in combined radiotherapy.** Zhidovtseva, M.I.; Shutilova, A.A.; Dynnik, M.S.; Lugovskaya, K.A.; Duma, V.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). pp 111-116 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

Data on studying stomach motor function in patients with carvix uteri carcinoma of 2 and 3 stages in combined radiotherapy are given. The patients were examined before radiotherapy and directly after it as well as in 1-2 years using the X-ray method for 50 patients and electrogastrography for 68 patients. Revealed changes in stomach motor function, being considered as a response to irradiation, were manifested more often in decreasing motility, evacuatory function and bioelectric stomach activity. These functional changes result in disturbance of general state of patients, appearance of symptomatology of stomach dysfunction and serve as indications for the prescription of correcting therapy, which includes diet and preparations strengthening stomach motor activity.

1241 **Thrombelastographic indices in patients with syringomyelia treated with radioactive iodine.** Kudin, A.T.; Vais, Yu.I. (Ternopol'skij Meditsinskij Inst. (Ukrainian SSR)). pp 106-108 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

The thrombelastrographic method was used to study the effect of therapeutic doses of radioactive iodine on blood coagulation in 43 patients with syringomyelia. Before the application of the radiotherapy the patients had a trend to the blood coagulation increase. The trend to the normalization of some indices of thrombelastogram has been noted under the=effect of therapeutic doses of radioactive iodine.

1242 **Changes in thrombelastographic indices in patients with thyrotoxicosis treated with radioactive iodine.** Tsilyurin, I.T.; Volkov, L.A. (Ternopol'skij Meditsinskij Inst. (Ukrainian SSR)). pp 51-53 of Ehksperimental'naya i klinicheskaya radiologiya. Respublikanskij mezhduvedomstvennyj sbornik. Kiev, Ukrainian SSR; Zdorov'ya (1978). (In Russian)

Changes in the blood coagulation system have been studied by the thrombelastographic method in 42 patients with thyrotoxicosis treated with radioactive iodine. The decrease in thromboplastin formation, prothrombin transformation into trombin and the disturbance of fibrin formation were detected during thyrotoxicosis. Indices of blood coagulation are displaced to normalization under the effect of radioiodine-therapy.

1243 (INIS-mf—6419, pp vp) **Radiation risks from $^{125}I$ in RIA laboratories - internal contamination and burden to hands.** Husak, V.; Kleinbauer, K.; Budikova, M. (Fakultni Nemocnice, Olomouc (Czechoslovakia). Oddeleni Nuklearni Mediciny). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on radioimmunoassay; Hradec Kralove, Czechoslovakia (27 Apr 1978).

1244 (INIS-mf—6421, pp 7) **Problems of image quality, radiation burden and risk/benefit ratio in mammography.** Angerstein, W. (Forschungsinstitut fuer Lungenkrankheiten und Tuberkulose, Berlin-Buch (German Democratic Republic)). [nd]. (In Slovak and German). Dep. NTIS (US Sales Only).

From Diagnosis of mammary gland disorders; Piestany, Czechoslovakia (3 Oct 1979).

### 5603 Chemicals Metabolism And Toxicity

*REFER ALSO TO CITATION(S) 982, 1168, 1197*

1245 (INIS-mf—6531, pp vp) **DNA replication and repair in human cells exposed to ionizing radiation.** Ford, M.; Houldsworth, J.; Lavin, M. (Queensland Univ., St. Lucia (Australia). Dept. of Biochemistry). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1246 (INIS-mf—6531, pp vp) **Chemical protection against x-ray damage to animal cells in vitro.** Bick, Y.A.E. (Tasmania Univ., Sandy Bay (Australia). Dept. of Zoology; Brown, J.K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1979. Dep. NTIS (US Sales Only).

From 7. A.I.N.S.E. radiation biology conference; Lucas Heights, Australia (20 Aug 1979).

1247 **Influence of organic chelators on the toxicity of copper to embryos of the Pacific oyster, Crassostrea gigas.** Knezovich, J.P.; Harrison, F.L.; Tucker, J.S. (Lawrence Livermore Lab., CA). *Archives of Environmental Contamination and Toxicology;* **10**: No. 2, 241-249(1981).

The effects of copper on the development of Crassostrea gigas embryos were determined with a 48-hr static bioassay. In filtered, sterilized seawater from Bodega Bay, California, the LC100 was 20 microgram Cu/L, and the LC50 was 12 microgram Cu/L. Destruction of the naturally occurring dissolved organic material in the culture water by uv oxidation decreased embryo survival at 10 microgram Cu/L. The addition to seawater of five organic chelators (ethylenediaminetetraacetic acid (EDTA), sodium citrate, glycine, and oxalate at 1 x 10(-6) M, and humic matter at 2 mg/L) increased embryo survival. EDTA and humic matter were the most effective chelators; EDTA significantly increased survival at 100 microgram Cu/L and humic matter did so at 40 microgram Cu/L. The ability of a chelator to increase survival was related to the stability constant of the copper-chelator complex.

### 57 Health And Safety

*REFER ALSO TO CITATION(S) 991, 1050, 1052*

## 58 GEOSCIENCES

### 5801 Geology And Hydrology

*REFER ALSO TO CITATION(S) 13, 14, 15, 16, 17, 18, 19, 20, 22, 28, 31, 32, 33, 34, 35, 45, 46, 47, 48, 49, 50, 51, 66, 68, 69, 70, 72, 73, 81, 98, 106, 107, 198, 1025, 1026, 1271*

1248 **Nature of the continental crust beneath Britian.** Blundell, D.J. (Univ. of London, England). pp 58-64 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

In recent years a number of explosion seismic experiments have produced a network of crustal profiles across Britain, using refractions and wide-angle reflections of both p and s waves to model the structure and physical character of the crust. These indicate a number of layers, identified by seismic velocities, which are characteristic of particular crustal provinces and which appear to terminate abruptly at major tectonic lineaments recognized at the surface. Certain layers have been specifically identified with particular metamorphic basement facies, and it can be inferred that a substantial portion of the crust is made up of metamorphic rocks. Rec-

ognition of these features within the basement from near surface through to the middle and even the lower crust is leading to an appreciation of their importance in controlling crustal evolution, including epeirogenic processes of uplift and downwarping and sedimentary basin development. It is proposed that the extension of seismic reflection profiling to metamorphic terrain and to the examination of basement structures could provide the high resolution needed, in conjunction with the refraction and wide-angle reflection profiles and other geophysical methods, to gain a fuller understanding of crustal structure and eventually the mechanisms involved.

1249 **Palynology, its biostratigraphic and environmental potential.** Owens, B. (Inst. of Geological Sciences, Leeds, England). pp 162-168 of Petroleum geology of the continental shelf of northwest Europe. Illing, L.V.; Hobson, G.D. (eds.). London, England; Heyden and Son Ltd. (1981).

From 2. conference on petroleum geology of the continental shelf of North-West Europe; London, UK (4 May 1980).

The diverse range of palynomorphs (spores, pollen, acritarchs and dinoflagellate cysts) which can be readily extracted from a wide range of sedimentary lithofacies ranging in age from Cambrian to Quaternary provide a valuable means for biostratigraphic assessment. Palynomorph zonation schemes have been developed to varying degrees of finesse for most systems, although the effect of provincialism on both terrestrial and marine derived palynomorphs often restricts the range of their geographical application. Previous attempts at environmental evaluations have been limited to quantitative studies of palynomorph types and the establishment of relative values based on the ratio of marine to terrestrially derived palynomorphs in the sediment. This may now be expanded by the quantitative and qualitative assessment of the accompanying detrital kerogen to provide a more detailed environmental analysis.

1250 **Regional geology of the Pine Creek Geosyncline.** Needham, R.S.; Crick, I.H.; Stuart-Smith, P.G. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 1-22 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Pine Creek Geosyncline comprises about 14km of chronostratigraphic mainly pelitic and psammitic Lower Proterozoic sediments with interlayered tuff units, resting on granitic late Archaean complexes exposed as three small domes. Sedimentation took place in one basin, and most stratigraphic units are represented throughout the basin. The sediments were regionally deformed and metamorphosed at 1800Ma. Tightly folded greenschist facies strata in the centre grade into isoclinally deformed amphibolite facies metamorphics in the west and northeast. Pre and post-orogenic continental tholeiites, and post-orogenic granite diapirs intrude the Lower Proterozoic metasediments, and the granites are surrounded by hornfels zones up to 10km wide in the greenschist facies terrane. Cover rocks of Carpentarian (Middle Proterozoic) and younger ages rest on all these rocks unconformably and conceal the original basin margins. The Lower Proterozoic metasediments are mainly pelites (about 75 percent) which are commonly carbonaceous, lesser psammites and carbonates (about 10 percent each), and minor rudites (about 5 percent). Volcanic rocks make up about 10 percent of the total sequence. The environment of deposition ranges from shallow-marine to supratidal and fluviatile for most of the sequence, and to flysch in the topmost part. Poor exposure and deep weathering over much of the area hampers correlation of rock units; the correlation preferred by the authors is presented, and possible alternatives are discussed. Regional geological observations pertinent to uranium ore genesis are described.

1251 **Evolution of the Pine Creek Geosyncline.** Stuart-Smith, P.G.; Crick, I.H.; Needham, R.S. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Wills, K. (C.R.A. Exploration Pty Ltd., Winnellie, Australia). pp 23-37 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

An interpretation of the evolution of the geosyncline is described in four main stages. Stage 1. The geosyncline began to develop in the Early Proterozoic probably during incipient rifting and subsidence of Archaean basement. Continental and shallow marine sediments were deposited at the margins of the geosyncline while in its centre a thicker sequence of fine clastic and chemical sediments, and volcanics accumulated. Stage 2. Uplift of Archaean basement resulted in partial erosion of Stage 1 sediments and an influx of clastic material into the geosyncline. Sandstone and conglomerate formed extensive alluvial fans flanking the uplifted areas and graded distally into littoral and subtidal deposits which later transgressed over them. Stage 3. The third stage started with a tectonic event which caused uplift, folding and subsequent peneplanation of Stage 1 and 2 sediments. A new phase of sedimentation, dominated by chemical and organic sediments and felsic volcanics, accompanied a shallow marine transgression. A major shift in the locus of tectonic activity within the geosyncline from the centre to the west resulted in faulting and volcanism on the western margin and caused an influx of flysch-type sediment into the geosyncline to form an eastwards-thickening wedge. At the close of sedimentation sills of tholeiitic basalt were emplaced into the Early Proterozoic sediments. Stage 4. Continued subsidence of the geosyncline resulted in deformation, metamorphism and partial anatexis of the Early Proterozoic sediments, and some subsequent igneous activity. The sediments were uplifted, eroded and overlain by flat-lying Middle Proterozoic, younger Proterozoic, Palaeozoic and Mesozoic rocks, indicating continued tectonic stability since early Middle Proterozoic times.

1252 **Geochronology and evolution of the late-Archaean basement and Proterozoic rocks in the Alligator Rivers Uranium Field, Northern Territory, Australia.** Page, R.W.; Needham, R.S. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Compston, W. (Australian National Univ., Canberra. Research School of Earth Sciences). pp 39-68 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

U-Pb zircon and monazite studies, together with Rb-Sr and K-Ar total-rock and mineral studies, have been undertaken on various suites of amphibolite-grade gneisses and schists, granulites, intrusive granites, volcanic rocks, and dolerites in the Alligator Rivers Uranium Field. These studies cover all the major rock units of the region, and lead to the establishment of an overall chronology which is geologically consistent, and with which any petrogenetic hypothesis or model of mineralization is constrained.

1253 **Granite ages in the Pine Creek Geosyncline.** Riley, G.H. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Mineral Physics). pp 69-72 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Rb-Sr data on high-level, late orogenic granitoid intrusions in the Pine Creek Geosyncline indicate that their emplacement was essentially synchronous. Low initial $^{87}Sr/^{86}Sr$ ratios strongly suggest that they did not originate by anatexis of crustal material of high Rb/Sr ratio but from a source of primitive strontium with low enrichments of $^{87}Sr$. The Allia Creek granite may be an exception. The geographic distribution of sampling sites demonstrates that this intrusive event was widespread throughout the Geosyncline in the early Proterozoic. The age of 1780+-20 m.y. is therefore interpreted as representing a minimum age for the regional metamorphism of the Pine Creek Geosyncline and a maximum age for the development of high grade, vein type, uranium mineralization.

1254 **Granitoids in the Pine Creek Geosyncline.** Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Chappell, B.W. (Australian National Univ., Canberra. Dept. of Geology); Goleby, A.B. pp 73-90 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Granitoid rocks are extensively developed in the Pine Creek Geosyncline. These granitoids are of two distinct ages - Archaean and late Lower Proterozoic to early Middle Proterozoic. Whole-rock Rb-Sr isochrons and zircons record Archaean ages for the Rum Jungle and Waterhouse Complexes; K-Ar dates on minerals from Rum Jungle record an approximately 1800 m.y. regional metamorphic event. Isotopic dating of the Nanambu Complex indicates an Archaean age, but also reactivated approximately 1800 m.y. granitoid components. These complexes have features in common with mantled gneiss domes. The little known Litchfield Complex appears to have a history similar to that of the Nanambu Complex. The Nimbuwah Complex is atypical in that the zircons record an 1870 m.y. orogenic event and the Archaean component is apparently absent. Post approximately 1800 m.y. regional metamorphism, granitoids formed late-orogenic semi-conformable to highly transgressive plutons with ages ranging from late lower Proterozoic to early Middle Proterozoic. The complexes contain a mixture of S- and I-type granitoids except the Nimbuwah which is exclusively of I-type. The Nimbuwah Complex differs from the other complexes: it is the most mafic, impoverished in lithophile elements including U and Th, has a low initial $^{87}Sr/^{86}Sr$ ratio, and is associated with granulites. The data suggest alternative interpretations: the late-orogenic granitoids may represent products of a small degree of partial melting ('minimum temperature'), end products of fractionation or derivation from a source moderately high in potassium and silica. However, the complex granitoids, particularly the I-types, could be interpreted as products of a large degree of partial melting ('non-minimum temperature') from a source rich in silica and calcium or of mildly fractionated rocks. The mafic Nimbuwah Complex, with marked low lithophile content, may represent residuum after extraction of a more felsic component.

1255 **Metamorphism in the Pine Creek Geosyncline and its bearing on stratigraphic correlations.** Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 91-100 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Within the Pine Creek Geosyncline two broad zones of regional metamorphic grade are present. The boundary which separates these two provinces coincides, in part, with the northerly trending South Alligator Hinge Zone at approximately 132°30'E. Rocks to the northeast of this divide (Province I) are regionally metamorphosed to medium and high-grade, whereas elsewhere in the Pine Creek Geosyncline low-grade regional metamorphism is encountered (Province II). P-T estimates for the medium-grade metamorphism are in the range 5-8 kb and 550°-630°C; these rocks grade into anatectic granitoids. Also present in Province I are granulites falling within an estimated P-T field of 7-10 kb and 700°-800°C. Mineral parageneses encountered in the regionally metamorphosed rocks of Province II point to a P-T regime of $P < 4$ kb (possibly $< 2$ kb) and a temperature range of about 400°-500°C. The dramatic contrast of metamorphic grade across the South Alligator Hinge Zone and the 15-30km of cover rocks needed to produce the medium to high-grade metamorphism in Province I raises problems if these rock units have correlatives in Province II. Consideration is given to the possibility that the rocks east of the South Alligator Hinge Zone in Province I may have been basement as well as provenance area during the sedimentation in the Pine Creek Geosyncline.

1256 **Study of the Pine Creek Geosyncline using integrated Landsat and Aeromagnetic data.** Simpson, C.J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Huntington, J.F.; Leishman, J.; Green, A.A. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Mineral Physics). pp 141-155 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Computer-enhanced Landsat imagery with newly developed Landsat/Stereo-Magnetics imagery has been used to map lineaments in the Pine Creek Geosyncline. Comparison of lineaments with the distinct aeromagnetic lineaments caused by dolerite dykes suggests that the dykes are of different ages and are associated with different fracture sets. Landsat lineaments were combined with mapped faults, veins, and magnetic lineaments to provide a total fracture distribution for the geosyncline. Six major fracture directions were identified and some new structural zones defined, the most intensive being a northwesterly zone from Katherine to Noonamah. Statistical analysis of uranium, and gold mineralization suggests that there is a non-random relationship between both types of occurrences and the total fracture distribution. Though further refinements to the study methods are indicated the techniques have application to exploration strategy in the Geosyncline.

1257 **Overview of metallic mineralization in the Pine Creek Geosyncline.** Needham, R.S. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)); Roarty, M.J. (Department of Northern Territory, Darwin (Australia)). pp 157-173 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Although renowned for its relatively recently discovered large uranium deposits, the Pine Creek Geosyncline has a history of exploitation dating back to 1865, during which time 16 metals have been extracted. Uranium makes up 96.8 percent of the value of recorded production and reserves at present metal prices, lead 1.9 percent, gold and zinc 0.32 percent each, iron 0.2 percent, silver 0.2 percent and all other metals 0.3 percent. The Alligator Rivers Uranium Field accounts for 95 percent of the total value of recorded production and reserves, the Rum Jungle Uranium Field 4 percent, and all other areas 1 percent. Deposits range from stratiform through stratabound to vein-type. Most have undergone some degree of alteration or remobilisation, and extreme metasomatism in some masks clues to the earlier evolution of the deposits. Small vein-type hydrothermal deposits, clustered around intrusive granites, predominate. Other deposits can be sub-divided into those associated with the basement, those associated with the Masson and Cahill Formations, and those associated with the Gerowie Tuff, Koolpin, and Kapalga Formations. Many deposits have undergone supergene concentration near the surface, and some have been formed predominantly by this process. Uranium appears to have been mainly derived from Archaean source rocks, and base metals and some precious metals from volcanic exhalative sources. Main areas of potential are the Alligator Rivers region for uranium and possibly gold, and the central part of the geosyncline for base metals.

1258 **Proterozoic tectonic model for northern Australia and its economic implications.** Rossiter, A.G.; Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 209-232 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

It is argued that at the end of Archaean time the Australian continent was confined to the area now occupied by the Yilgarn, Pilbara, Gawler, and Musgrave Blocks, and the southern part of the Arunta Block. During the Early Proterozoic, sedimentary and volcanic rocks were laid down in an extensive depositional zone trending roughly east-west along the northern margin of the Archaean continent. Copper and gold mineralization, commonly showing stratigraphic control, is widespread in this belt. Following deformation and metamorphism of the Early Proterozoic rocks, felsic and mafic igneous activity, and accumulation of platform sediments on the newly stabilized crust, a predominantly north-south depositional zone developed along the eastern margin of the continent during the Middle Proterozoic. Lead and zinc assume much more importance in the mineral deposits of this belt. It is postulated that the present positions of rocks of the Pine Creek and Georgetown regions are due to horizontal displacements of several hundred kilometres along major fault zones. Apparent rifting of these blocks away from palaeo-continental margins may be related to the occurrence of uraniferous granitic rocks and uranium mineralization within them via a mantle plume mechanism. Although current data are limited, tectonic environments suggested for Proterozoic mafic igneous rocks of northern Australia by their geochemistry are compatible with the geological settings of these rocks and with the tectonic model put forward.

1259 **Geology of the Litchfield province, N.T.** Berkman, D.A. (Australian Oil and Gas Co. Ltd., Sydney). pp 299-306 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Litchfield province is herein defined as the westernmost outcropping unit of the Pine Creek Geosyncline extending from the Giant's Reef Fault at about longitude 130°50'E westerly to the edge of the Bonaparte Gulf basin. The northern half of the province has been remapped using company drillhole data and a Bureau of Mineral Resources air magnetic-radiometric survey. Five areas have been found to be entirely granitoid, garnetiferous and gneissic in part, with composition in the range adamellite to granodiorite. A single Rb/Sr age of about 1800 m.y. has been published. The granitoid margins are migmatised and transitional into large areas of metasediments, varying in metamorphic grade from greenschist (fine grained chloritic graphitic schist) to upper amphibolite/granulite grade (course grained quartz - feldspar gneiss). The regional strike is northerly to northwesterly, and these metasediments are thought to merge into the Burrell Creek Formation beyond the border of the province. Two periods of metamorphism affected the Litchfield province metasediments, but only one phase can be detected in the granitoids, thus these are assumed to be younger, probably formed during the 1800 m.y. orogenesis known elsewhere in the Geosyncline. Minor areas of unmetamorphosed gabbro, dolerite and quartz-diorite occur, probably of Middle Proterozoic age. Cover rocks include quartz sandstones of the Middle Proterozoic Moyle River Formation and Depot Creek Sandstone, and Cambro-Ordovician sandstones of the Daly River Basin. The formation boundaries in the Litchfield province are not particularly confused or complicated, nor are the igneous lithologies particularly diverse. There is no evidence for an Archaean age for the part of the Litchfield province north of the Daly River, and it is thus proposed that the term 'Litchfield Complex' should be abandoned.

1260 **Geology and economic significance of the Golden Dyke Dome, Northern Territory.** Nicholson, P.M. (Peko Mines, Tennant Creek, Australia). pp 319-334 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

Rocks of the Lower Proterozoic South Alligator Group were deposited in a restricted basin. Mudstones were typically deposited, although during periods of restricted, clastic sedimentation, banded, ferruginous, chemical sediments, carbonates and cherts accumulated. An exhalative model is proposed for some stratiform mineralization hosted by these sediments. High geothermal gradients caused the circulation of oceanic and meteoric waters through the sediment pile and the underlying basement rocks. Resultant brines, which were both metal- and boron-rich, were periodically discharged onto the seafloor. These migrated towards, and collected in, local troughs where metal- and boron-rich sediments formed. Iron and base-metal sulphides were deposited from these brines when they encountered reducing conditions. Gold occurs in the iron-rich sediments. The base metal content of the brines and subsequent deposits increased markedly after tuffaceous sediments were added to the pile as these contained potentially accessible metals, and their leaching agent, chlorine.

1261 **Rb-Sr chronology of micas at Jabiluka.** Riley, G.H. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Mineral Physics); Binns, R.A.; Craven, S.J. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia). pp 457-468 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The deformation associated with high grade regional metamorphism predates emplacement of acid pegmatites whose muscovite component is dated at 1830 +- 5 m.y. Biotites from non-retrogressed, amphibolite facies schists have high enrichments of radiogenic $^{87}Sr$ and yield concordant model ages of 1805 +- 5 m.y. Associated muscovites have much higher common Sr concentrations than the biotites and radiogenic $^{87}Sr$ enrichments are therefore much lower. Although their apparent model ages are systematically higher than coexisting biotite, the data cannot be unequivocally related to a single event, but are consistent with an interpretation that peak regional metamorphism was close to the emplacement age of pegmatites. A post-metamorphic cooling rate of $8^0C$/m.y. is inferred from these data for the Cahill Formation. Retrogressive alteration near the Jabiluka Two ore zone is characterized by extensive development of sericite and chlorite. Model ages for retrogressive sericite in pegmatites, greisens and altered schists cover an extended period of time and no conclusive interpretation is possible. Similarly, sericite concentrates from the metamorphosed matrix of Kombolgie Formation sandstone and from the underlying metamorphosed regolith contain relatively high concentrations of common Sr so that model ages are equivocal. If the retrogressive metamorphism of the Cahill Formation and the prograde metamorphism of the Kombolgie Formation sandstone and its underlying regolith are viewed as an episode in which extensive homogenization of Sr isotopes occurred during crystallization of sericite, an isochron treatment of the data is appropriate and yields an age of 1534 +- 90 m.y. Alternatively, if no such homogenization occurred throughout the Jabiluka wall rocks during retrogession, the lowest model ages measured, namely ca. 1400 m.y., set a maximum limit for the time of alteration.

1262 **Tertiary oxidation in Westwater Canyon member of Morrison formation.** Saucier, A.E. *Memoir - New Mexico Bureau of Mineral Resources;* No. 38, 116-121(1980). (CONF-7905120—).

From New Mexico Bureau of Mines and Mineral Resources conference; Albuquerque, NM, USA (13 May 1979).

Hematitic oxidation in the Westwater Canyon Sandstone Member of the Morrison Formation extends along the outcrop from the Pipeline fault northeast of Gallup, New Mexico, to the San Mateo fault north of Grants, New Mexico. The hematitic sandstone forms a broad lobe in the subsurface to a depth of 2,400 ft (730 m). The downdip edge of this sandstone arcs eastward from northeast Church Rock through Crownpoint, and southeastward to the west edge of the Ambrosia Lake district. The red sandstone is bordered on the downdip side by a band of limonitic oxidation, which interfingers with reduced sandstones basinward. The limonitic oxidation forms a relatively narrow band along the north and west sides of the hematitic lobe but expands progressively in an east and southeast direction. Weak limonitic oxidation, as indicated by the absence of pyrite and by a bleached to faint yellowish-gray color, appears to extend from the San Mateo fault eastward under Mount Taylor to the Rio Puerco of the east. The hematitic oxidation is epigenetic and is believed to be of early Miocene to late Pliocene age. The limonitic oxidation follows the present groundwater flow pattern and probably dates from late Pliocene to the Holocene. The oxidation patterns are important in uranium exploration because the hematitic area is essentially barren, whereas the limonitic areas contain ore deposits that are in the process of being destroyed by oxidation.

1263 **How accurate is the $^{14}C$ method.** Nydal, R. pp 69-80 of Fortiden i soekelyset. $^{14}C$ datering gjennom 25 aar. Nydal, R.; Westin, S.; Hafsten, U.; Gulliksen, S. (eds.). Trondheim, Norway; Universitetsforlaget (1979). (In Norwegian)

From Jubilee symposium of the radiological dating lab; Trondheim, Norway (9 May 1978).

Radiocarbon daters have in recent years focussed their interest on accuracy and reliability of $^{14}C$ dates. The use of dates for resolving fine chronological structures that are not dateable otherwise has stressed this point. The total uncertainty in dating an event is composed of errors relating to dating of the sample, i.e. uncertainty in measured quantities, deviations from assumed content of $^{14}C$ in material when alive; and errors related to quality of sample material, i.e. contamination from carbon of different age, diffuse context between sample and event. Statistical variability in counting of $^{14}C$ activity gives the most important contribution to measurement uncertainty - increasing with age and shortage of sample material. Corrections for isotopic fractionation and reservoir effects must be performed, and - most important when dates are compared with historical ages - the dendrochronological calibration will correct for past variations in the atmospheric $^{14}C$ content. Future improvement of dating precision can however only be obtained by the combined efforts of both daters and submitters of samples, thus minimizing errors related to selection and handling of sample material as well as those related to the $^{14}C$ method and measurements.

## 5802 Geophysics

*REFER ALSO TO CITATION(S) 17, 19, 21, 22, 23, 24, 30, 976, 1001, 1248*

1264 **Characteristics and interpretation of regional gravity, magnetic and radiometric surveys in the Pine Creek Geosyncline.** Tucker, D.H.; Stuart, D.C.; Hone, I.G.; Sampath, N. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). pp 101-140 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Bureau of Mineral Resources, Geology and Geophysics (BMR) has covered the Pine Creek Geosyncline with helicopter gravity stations on an 11,000m grid, and airborne magnetic and gamma spectrometer surveys along east-west lines 150m above ground level and 1500m apart. These data are available as maps at various scales, and most recently at 1:500,000 scale to overlay a geological map of the region at the same scale (BMR 1979a, 1979b, 1979c and 1979d). Inspection of the new regional maps shows that most of the known uranium deposits lie in areas of magnetically disturbed metasediments near residual Bouguer anomaly lows associated with radioactive granites. Some of these regional associations have been reported elsewhere (Stephansson and Johnson, 1976; Horsfall and Wilkes, 1975; Tucker, Hone, Sampath and Ewers, 1979). To better understand the links between the regional geophysics and regional geology, BMR undertook a multidisciplinary investigation of the geophysical characteristics of the Pine Creek Geosyncline during 1977 and 1978. The investigation included detailed ground surveys over anomalies, field and laboratory studies of rock physical properties, mineralogy studies, geological mapping, and computer modelling of anomaly sources.

1265 (INIS-mf—6422, pp vp) **First radiometric logging studies in Czechoslovakia in surveying geological dislocations.** Jirkovsky, R. (Vysoka Skola Banska, Ostrava (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

1266 (INIS-mf—6422, pp vp) **Possibility of determining rock massif stress by isotope methods.** Dvorak, D.; Keclik, L. (Vedeckovyzkumny Uhelny Ustav, Ostrava-Radvanice (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

1267 (INIS-mf—6422, pp vp) **Study of some characteristics of a rock massif by radioisotope methods.** Keclik, L.; Dvorak, D. (Vedeckovyzkumny Uhelny Ustav, Ostrava-Radvanice (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

1268 (INIS-mf—6422, pp vp) **Detection of rock massif stress changes by gamma-gamma logging in Prague underground tunnelling.** Tesar, O. (Projektovy Ustav Dopravnich a Inzenyrskych Staveb, Prague (Czechoslovakia)). [nd]. (In Czech). Dep. NTIS (US Sales Only).

From Nuclear methods in mining, geology, geophysics and geochemistry; Visolaje, Czechoslovakia (11 Sep 1979).

## 5803 Mineralogy, Petrology, And Rock Mechanics

*REFER ALSO TO CITATION(S) 75, 77, 84, 86, 87*

1269 **Hysteresis behaviour of soils and rocks.** Hueckel, T. (Polska Akademia Nauk, Warsaw. Inst. Podstawowych Problemow Techniki); Nova, R. (Politecnico di Milano (Italy). Istituto di Scienza e Tecnica delle Costruzioni). pp K1/7 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. K(a). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A theory of mechanical hysteresis of geological materials under alternating loading within the yield locus is studied, with emphasis on isotropic pressure sensitivity effects. The hysteresis is described by a 'secant' tensorially linear law which depends on a scalar parameter varying with the advance of the cycle. The constitutive relations are formulated piece-wisely within appropriately conceived stress reversal loci. Specialization to conventional triaxial tests is considered. Finally the feasibility of the model is examined by comparing calculated and actual test data, including those obtained in a cyclic undrained compression test which enlights the phenomenon of cyclic mobility.

1270 **Model for soil behavior under monotonic and cyclic loading conditions.** Dafalias, Y.F. (California Univ., Davis (USA). Dept. of Civil Engineering). pp K1/8 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. K(a). Seismic response analysis of nuclear power plant systems. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A mathematical model capable of describing the soil behavior under any loading conditions, monotonic or cyclic, is presented within the framework of critical state soil mechanics.

1271 **Internal isochrone method in accessory zircon dating.** Bibikova, E.V.; Gracheva, T.V.; Makarov, V.A. pp 24-31 of Isotope methods for age estimation in geology. Chukhrov, R.V. (ed.). Moscow; Nauka (1979). (In Russian)

Validity of initial ideas of dating on the basis of internal isochrone and geological situations at which such dating is possible are checked up. Probability of obtaining the false isochrones when dating of various fractions of accessory zircon is revealed for the case of multiple transformations of zircon-containing rock. The dating with respect to terrigenous zircon of metamorphic rocks probably due to the content of different quantities of terrigenous component in various zircon fractions may correspond only to minimum ages, if one-stage alteration of zircon is not proved. The method of dating based on the internal isochrone may be used for late-Pre-Cambrian and even younger formations, for which the danger of multiple disturbances of the U-Pb system in accessory zircons is absent. For the dating of more ancient rocks the above method is usable only at proved lack of multiple metamorphism phenomena in the region under investigation.

## 5804 Geochemistry

*REFER ALSO TO CITATION(S) 25, 66, 67, 76, 79, 82, 85, 90, 99, 113, 132, 212*

1272 **Geochemical investigations in the Mt. Bundey area, Northern Territory.** Hochman, M.B. (Adelaide Univ. (Australia)). pp 335-342 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

A geochemical study of the Mt. Bundey Granite/Mt. Goyder Syenite involving major elements and the trace elements Ba, Sr, Rb, Y, Zr, Nb, Ce, Nd, Sc and U has been carried out. The results indicate that the granitoids were formed by fractionation from an intermediate liquid which may have been produced by partial melting of a siliceous granulite in the lower crust. Samples of dolerites, lamprophyres, volcanics of the Gerowie Tuff and sediments of the Koolpin Formation were also analyzed, but the limited number of samples prevents any interpretation of these results.

1273 **Mercury distribution in the Jabiluka Two orebody and its host rocks.** Ryall, W.R.; Binns, R.A. (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, North Ryde, Australia). pp 469-476 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

The Jabiluka Two orebody contains a geochemically significant amount of mercury. Uraninite ores from the Upper Graphite Series (UGS) average 360 ppb Hg (range 190 to 470) whereas those from the Main Mine Series (MMS) remote from gold mineralization average 1950 ppb (range 660 to 5920). Higher mercury concentrations are present in the gold-rich, western part of the orebody. Native gold, which occurs principally in breccia zones within the MMS contains up to 450,000 ppb Hg. Uraninite concentrates from auriferous ore contain up to 11,000 ppb Hg, but programmed heating studies indicate about three-quarters of the mercury to be located in gold inclusions. Away from high grade gold mineralization the presence of mercury has been established within both uraninite and associated sulphide minerals. The immediate host rocks to uraninite veins generally contain more than 100 ppb Hg but only a few metres from ore the levels of both U and Hg fall to background levels of about 7 ppm and 20 ppb, respectively. Graphite schists adjacent to uraninite veins and breccias in the MMS average 300 ppb and those from unmineralized intervals average 220 ppb. Most Hg in graphite schists is located in pyrite lenticles, which adjacent to ore, average 5000 ppb in the UGS and 9100 ppb Hg in the MMS. Lenticles from a barren drill hole average 1900 ppb in UGS and 2500 ppb Hg in MMS compared with only 200 ppb in graphite schists remote from mineralization. Greisen-like rocks above mineralized MMS contain anomalously high mercury levels (average 450 ppb). Samples of unweathered Kombolgie Sandstone contain only 10 to 20 ppb Hg. The mercury content of gold-free uranium ore is strongly correlated with the uranium, arsenic and lead contents.

There is no significant correlation of Hg with either total sulphur or other chalcophile elements.

1274 **Distribution of U, Th and K through a section of the granitic crust of the Vredefort basement.** Hart, R.J. (University of the Witwatersrand, Johannesburg (South Africa). Nuclear Physics Research Unit); Nicolaysen, L.O. (University of the Witwatersrand, Johannesburg (South Africa). Bernard Price Inst. of Geophysical Research); Gale, N.H. (Oxford Univ. (UK). Dept. of Geology and Mineralogy). pp 707-708 of Uranium in the Pine Creek Geosyncline. Proceedings of the international uranium symposium on the Pine Creek Geosyncline jointly sponsored by the Bureau of Mineral Resources, Geology and Geophysics and the CSIRO Institute of Earth Resources in co-operation with the IAEA and held in Sydney, Australia 4-8 June 1979. Vienna, Austria; International Atomic Energy Agency (1980).

From International uranium symposium on the Pine Creek Geosyncline; Sydney, Australia (4 Jun 1979).

1275 **Oxygen isotope geothermometry on high-grade metamorphic rocks.** Bakshi, A.K.; Wilson, A.F. (Queensland Univ., St. Lucia (Australia). Dept. of Geology and Mineralogy). pp 27-33 of Proceedings of the seminar on mass spectrometry - applications and current trends [held at] Bombay, March 20-22, 1978. Bombay, India; Department of Atomic Energy (1979).

From Seminar on mass spectrometry: Applications and current trends; Trombay, Bombay, India (20 Mar 1978).

Oxygen extraction by the $BrF_5$ technique was carried out on minerals separated from granulite facies rocks, collected from the Fraser and Strangways Ranges, Australia. The gas samples were analysed as oxygen (not as $CO_2$) on an Atlas $CH_4$ mass spectrometer. The various mass spectrometric corrections necessary were evaluated in a manner analogous to that of Dienes (1970); the mixing, leak, background and abundance sensitivity corrections all proved to be very small, indicating that the $CH_4$ is well-suited for $^{18}O/^{16}O$ isotopic ratio measurements. The low delta differences (approximately 1 to 3%) exhibited by the mineral-pairs in these granulites, were measured precisely, and indicate oxygen isotopic equilibration temperatures of around 700deg C.

### 5805 Oceanography

*REFER ALSO TO CITATION(S) 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 32, 33, 34, 35, 45, 46, 47, 48, 49, 51*

## 64 PHYSICS RESEARCH

1276 **A.I.P. 4th national congress, Melbourne 1980.** Melbourne, Australia; Australian Institute of Physics (1980). vp. (CONF-8008127—).

From 4. National congress of the Australian Institute of Physics; Melbourne, Australia (25 Aug 1980).

Individual items from the congress were prepared separately for the data base. (GHT)

### 6401 Astrophysics And Cosmology

*REFER ALSO TO CITATION(S) 947, 948, 949*

1277 (INIS-mf—6290, pp 4-5) **Definition of solar cosmic ray energy spectra in a source.** Aitbaev, F.B.; Baisakalova, A.B.; Gainova, L.E.; Kolomeets, E.V.; Sevast'yanov, V.N. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (USSR)). 1980. (In Russian). Dep. NTIS (US Sales Only).

In Cosmic and physical aspects of cosmic ray investigations. International seminar.

1278 (INIS-mf—6290, pp 7-8) **Propagation in the interplanetary space of solar cosmic rays produced in solar flares at longitudes of 46-48 deg in September-November 1973.** Vakulov, N.V.; Vologdin, N.I.; Kuzhevskii, B.M.; Mineev, Yu.V.; Spir'kova, E.S.; Shestopalov, I.P. (AN SSSR, Moscow. Inst. Zemnogo Magnetizma, Ionosfery i Rasprostraneniya Radiovoln). 1980. (In Russian). Dep. NTIS (US Sales Only).

In Cosmic and physical aspects of cosmic ray investigations. International seminar.

1279 (INIS-mf—6290, pp 51) **Structure of Forbush decreases during geomagnetic storm development with sudden commencement according to observations in the Arti observatory during 1978.** Belyaev, V.A.; Zakharchenko, V.F.; Ivanova, L.N. (AN SSSR, Sverdlovsk. Inst. Geofiziki). 1980. (In Russian). Dep. NTIS (US Sales Only).

In Cosmic and physical aspects of cosmic ray investigations. International seminar.

1280 (INIS-mf—6385, pp 122-123) **Electromagnetic properties of a cosmic ray gas and diamagnetism of solar cosmic rays in magnetic traps.** Okulov, Yu.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

From CAPG symposium on solar-terrestrial physics; Ashkhabad, USSR (22 Oct 1979).

1281 (INIS-mf—6385, pp 123) **Energy exchange between cosmic rays and the solar wind.** Dorman, L.I. (AN SSSR, Moscow. Inst. Zemnogo Magnetizma, Ionosfery i Rasprostraneniya Radiovoln); Yukhimuk, A.K.; Kats, M.E.; Fedorov, Yu.I.; Shakhov, B.A. (AN Ukrainskoj SSR, Kiev. Inst. Geofiziki). 1979. (In Russian). Dep. NTIS (US Sales Only).

From CAPG symposium on solar-terrestrial physics; Ashkhabad, USSR (22 Oct 1979).

1282 (INIS-mf—6385, pp 124-125) **Structure of the neutral sheet of the interplanetary magnetic field according to measurements of cosmic ray intensity and anisotropy.** Alaniya, M.V.; Aslamazishvili, R.G.; Dzhapishvili, T.V. (AN Gruzinskoj SSR, Tbilisi. Inst. Geofiziki). 1979. (In Russian). Dep. NTIS (US Sales Only).

From CAPG symposium on solar-terrestrial physics; Ashkhabad, USSR (22 Oct 1979).

1283 (INIS-mf—6385, pp 151) **Energy of large solar and discrete structure of geoeffective solar corpuscular fluxes.** Mogilevskii, E.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

From CAPG symposium on solar-terrestrial physics; Ashkhabad, USSR (22 Oct 1979).

1284 (INIS-mf—6385, pp 153-154) **Substance ejection and shock waves on solar plasma pulsed heating.** Sermulinya, B.Ya.; Spektor, A.R. (AN Latvijskoj SSR, Riga. Radioastrofizicheskaya Observatoriya); Somov, B.V.; Syrovatskii, S.I. (AN SSSR, Moscow. Fizicheskij Inst.). 1979. (In Russian). Dep. NTIS (US Sales Only).

From CAPG symposium on solar-terrestrial physics; Ashkhabad, USSR (22 Oct 1979).

1285 (INIS-mf—6385, pp 158) **Emission energy of optical solar flares of different power.** Kurochka, L.N.; Ostapenko, V.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From CAPG symposium on solar-terrestrial physics; Ashkhabad, USSR (22 Oct 1979).

1286 (INIS-mf—6385, pp 160-161) **Development and energy of the solar flare on November 22, 1977.** Val'nichek, B.I. (Slovenska Akademia Vied, Skalnate Pleso (Czechoslovakia). Astronomicky Ustav); Likin, O.B.; Morozova, E.I.; Pisarenko, N.F.; Ehstulin, I.V. (AN SSSR, Moscow. Inst. Kosmicheskikh Issledovanij). 1979. (In Russian). Dep. NTIS (US Sales Only).

From CAPG symposium on solar-terrestrial physics; Ashkhabad, USSR (22 Oct 1979).

1287 (JINR-D—12831, pp 9-20) **Inverse problems of astrophysics.** Ambartsumyan, V.A. (AN Armyanskoj SSR, Byurakan. Astrofizicheskaya Observatoriya). 1979. (In Russian). Dep. NTIS (US Sales Only).

From Fundamental problems of theoretical and mathematical physics conference; Dubna, USSR (23 Aug 1979).

The application of the method of inverse problems is shown to the solutions of different astrophysical problems: distribution of brightness over the disk of stars, space distribution of luminosity in spherical galaxies and of stars in globular clusters, determination of density in the phase space. The inverse problems of stellar kinematics, determination of space velocity distribution functions for near solar stars of different physical types, have been considered. A statistical method for defining the flares occurring in star associations and clusters has been proposed. Inadequacy of this approach, as applied to astrophysical problems, is shown. It is also noted that the method of inverse problems provides potentialities of estimating the accuracy, unambiguity and limits of applicability of solutions obtained.

1288 **Evolution of coronal and interplanetary magnetic fields.** Levine, R.H. (Harvard Univ., Cambridge, MA (USA). Center for Astrophysics). pp 1-20 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Numerous studies have provided the detailed information necessary for a substantive synthesis of the empirical relation between the magnetic field of the sun and the structure of the interplanetary field. The author points out the latest techniques and studies of the global solar magnetic field and its relation to the interplanetary field. The potential to overcome most of the limitations of present methods of analysis exists in techniques of modelling the coronal magnetic field using observed solar data. Such empirical models are, in principle, capable of establishing the connection between a given heliospheric point and its magnetically-connected photospheric point, as well as the physical basis for the connection.

1289 **SIMS measurements of magnesium isotopic abundance ratio in the Allende carbonaceous chondrite.** Nishimura, H.; Okano, J. (Osaka Univ., Toyonaka (Japan). Coll. of General Education). pp 513-521 of Advances in mass spectrometry. Volume 8A. Proceedings of the 8th international mass spectrometry conference held at Oslo, 12-18 August 1979. Quayle, A. (Shell Research Ltd., Chester (UK)) (ed.). London, England; Heyden for the Institute of Petroleum (1980).

From 8. international mass spectrometry conference; Oslo, Norway (11 Aug 1979).

Aluminium 26 is one of the extinct nuclides. It decays to $^{26}Mg$ with the half life of $7.2 \times 10^5$ y. In order to confirm whether $^{26}Al$ existed in the early solar system or not, magnesium isotopic abundance anomalies have been examined in some chondrites and terrestrial rocks by many investigators. In the present work point-to-point (SIMS) analyses of Mg isotopic anomalies were carried out for the Allende inclusions and matrix with an accuracy of about 3 parts per thousand. They were compared with that for the terrestrial forsterite sample. The results are presented and discussed.

1290 **Search for giant cells in the solar convection zone.** LaBonte, B.J.; Howard, R. (Hale Observatories, Pasadena, CA (USA)). pp 21-23 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The Mount Wilson Observatory has obtained daily full disk digital magnetograms of the Sun since 1966, with 12 to 17 arcsecond resolution. As each magnetogram is taken, the position of the Doppler line shift compensator is also recorded, thus giving a full disk map of the longitudinal velocity. This entire dataset is currently being rereduced on a uniform basis (Howard et al., 1980), and daily arrays of residual velocities are being formed by removing large scale patterns, e.g., Earth's motions, solar rotation, limbshift. Data from the years 1972 through 1978 are used.

1291 **Dynamics of large-scale magnetic field evolution during solar cycle 20.** McIntosh, P.S. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). pp 25-28 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The evolution of large-scale solar magnetic fields has been studied for a complete solar cycle using the atlas of H-alpha synoptic charts for 1964-1974. The results include: a unique magnetic pattern coinciding with major coronal holes; variations in the rate of solar rotation through the solar cycle; discovery of convergence and divergence among long-lived magnetic patterns; periodic discontinuities in the organization of large-scale magnetic fields; and a new cause for coronal transients.

1292 **Two-level solar dynamo based on solar activity, convection, and differential rotation.** Bratenahl, A.; Baum, P.J. (California Univ., Riverside (USA)); Adams, W.M. (Aerospace Corp., El Segundo, CA (USA)). pp 29-32 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

In orthodox dynamo theory the two basic processes, generation of toroidal from poloidal field and conversion of toroidal into reversed poloidal field, are both located in the high $\beta$ regime convection zone. The authors present a two-level dynamo theory in which conversion may be observed directly, since it is expected to express itself in terms of all forms of solar activity: sunspots, flares, faculae, filaments, coronal structures including coronal holes, etc., and their organization and evolution in a 'solar meteorology'.

1293 **Location of compact microwave sources with respect to concentrations of magnetic field in active solar regions.** Gaizauskas, V.; Tapping, K.F. (Herzberg Institute of Astrophysics, Ottawa (Canada)). pp 33-36 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The slowly varying (S-) component of solar microwave emission originates in the vicinity of sunspots and chromospheric plages. A significant portion of this component is produced by bright, compact sources which are much smaller than the active regions in which they occur. The combined radio-optical investigation reported was initiated to explore, in regions at various stages of evolution, both the variability of compact microwave sources and their association with specific optical features.

1294 **Radio observations of coronal holes.** Sheridan, K.V.; Dulk, G.A. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). pp 37-43 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Coronal holes have been observed on several occasions with the 80 and 160 MHz radioheliograph at Culgoora. At 160 MHz the holes invariably appear as areas of low brightness, either on the disk or at the limb. At 80 MHz holes on the limb always appear less bright than their surroundings but on the disk they frequently appear brighter. The simplest interpretation is that the coronal temperature in holes near the 80 MHz critical density ($8 \times 10^7$ cm$^{-3}$) is higher than in normal quiet regions, but that the density at this level is lower.

1295 **Model for the north coronal hole observed at the 1973 eclipse, between 1.3 and 3.2 solar radii.** Crifo, F.; Picat, J.P. (Observatoire de Paris, Section de Meudon, 92 (France)). pp 45-48 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

At the 1973 eclipse, several pictures of the white-light corona were obtained using polarizers and a radially-compensated filter. These pictures provide a very good opportunity for studying the large coronal hole at the north polar cap; this hole has been extensively studied during the Skylab period. On the plates reliable intensities between 1.3 and 3.2 solar radii could be recorded. The absolute calibration was made using the stars observed in the field at the same time. This method allows a direct comparison of well-exposed objects on a same plate and must therefore be highly reliable. The northern hole was very dark and from the synoptic maps and the X-ray pictures, one can conclude that probably no high-latitude streamers were projected over the hole in the plane of the sky. Intensities in the radial and tangential directions of polarization were recorded in the darkest part of the hole between the visible plumes.

1296 **Possibility of identifying coronal holes on synoptic maps of the green corona.** Letfus, V. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav); Kulcar, L.; Sykora, J. (Slovenska Akademia Vied, Skalnate Pleso (Czechoslovakia). Astronomicky Ustav). pp 49-53 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The coronal holes of the Skylab period are treated to identify them with the low-brightness regions in the synoptic maps of the lambda 530.3 nm emission corona. Possibilities and difficulties of this identification are discussed.

1297 **Solar observations with a new Earth-orbiting coronagraph.** Sheeley, N.R. Jr.; Howard, R.A.; Michels, D.J.; Koomen, M.J. (Hulbert (E.O.) Center for Space Research, Washington, DC (USA)). pp 55-59 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Since March 28, 1979, the Solwind coronagraph has been observing the Sun's white light corona (2.6 - 10.0 solar radii) routinely with a spatial resolution of approximately 1.25 arc min and a repetition rate of 10 minutes during the one-hour sunlit portion of each 97-minute satellite orbital period. These are the first satellite observations of the outer corona near the peak of a sunspot cycle when coronal transients and high-latitude streamers are common.

1298 **X-ray structures associated with disappearing Hα filaments in active regions.** Kahler, S.W. (American Science and Engineering, Inc., Cambridge, MA). pp 61-65 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The author examines in detail the relationship between active region disappearing Hα filaments and the associated coronal X-ray structure observed both before the disappearance event and afterwards. The results presented constitute a 'first order' overview of the events chosen for study.

1299 **Origin of interplanetary sectors.** Schatten, K.H. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). pp 67-72 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The author discusses several coronal magnetic models that allow calculations of the coronal magnetic field from the observed photospheric magnetic field and shed light on the origin of sectors. He then relates the discovery of coronal holes, comparing their locations with the coronal magnetic field models. Finally, the author clears up some misconceptions about interplanetary magnetic field sectors.

1300 **Coronal structure and solar wind.** Tandon, J.N. (Delhi Univ. (India). Dept. of Physics and Astrophysics). pp 73-78 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Recent observations of large scale coronal structures and solar wind have been studied. The intercorrelation of the two have been qualitatively explained through the focussing of solar-ion streams taking account of the local and general solar magnetic fields. This explains the asssociation of coronal holes with weak, diverging open magnetic field lines and envisages the transfer of hydromagnetic wave energy from nearby active centers to account for the enhanced outflow of solar wind associated with coronal holes.

1301 **Solar polar field reversals and secular variation of cosmic ray intensity.** Ahluwalia, H.S. (New Mexico Univ., Albuquerque (USA). Dept. of Physics and Astronomy). pp 79-86 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The profile of the well-known 11-year variation of the cosmic ray intensity appears to depend upon the emerging solar polar magnetic field regime in a very characteristic manner. During the solar activity cycle 19, the cosmic ray intensity takes about seven years to recover to its solar activity minimum level. But during the solar activity cycle 20, the recovery takes place in only about two years. It appears that these characteristic recovery modes are obtainable every other solar activity cycle. Two model configurations for the heliosphere are suggested. The author believes that an 'open' heliosphere model applies to solar activity cycles 18 and 20. A 'closed' heliosphere model is obtainable during solar activity cycles 17 and 19. The results are discussed.

1302 **Coronal responses of the large-scale and long-term phenomena of the lower layers of the Sun.** Sykora, J. (Slovenska Akademia Vied, Skalnate Pleso (Czechoslovakia). Astronomicky Ustav). pp 87-104 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Based on the assumption, generally accepted over the past decade, that all the forms of solar and interplanetary activity are responses to the magnetic fields generated initially in the subphotosphere, some characteristics of the large-scale and long-term behaviour of the solar corona during the last three solar cycles are presented. Most of the report is based on the statistical and graphical processing of the abundant observational material pertinent to 530.3 nm Fe XIV coronal line. Apart from these, some white-light corona and EUV observations were used to demonstrate the long-term phenomena. Namely, the longitudinal and latitudinal distributions of the corona brightness are shown and, in this connection, active longitudes and coronal rotation are discussed. Some solar cycle properties and N-S asymmetry are compared with similar features found for sunspots and solar flares. Large-scale characteristics and long-term evolution of coronal holes are briefly summarized.

1303 **Interplanetary response to solar long time-scale phenomena.** D'Uston, C.; Bosqued, J.M. (Toulouse-3 Univ., 31 (France). Centre d'Etude Spatiale des Rayonnements). pp 105-125 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors briefly review the experimental knowledge gained in the recent years on the interplanetary response to solar long-time scale phenomena such as the coronal magnetic structure and its evolution. Observational evidence that solar wind flow in the outer corona comes from the unipolar diverging magnetic regions of the photosphere is discussed along with relations to coronal holes. High-speed solar wind streams observed within the boundary of interplanetary magnetic sectors are associated with these structures. Their boundaries appear as very narrow velocity shears. The value of the maximum velocity increase is related to the amount of divergence of the field lines at the base of the corona which is less in large unipolar regions and causes the expansion to be faster according to theoretical models. Radial variations and solar cycle modulations of these structures are also presented.

1304 **Stellar mass flux and coronal heating by shock waves.** Couturier, P.; Mangeney, A. (Observatoire de Paris, Section de Meudon, 92 (France)); Souffrin, P. (Observatoire de Nice, 06 (France)). pp 127-130 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The heating of the solar corona and the solar wind phenomenon are basically related, however, the two parts are generally modelised independently: the models of the transition zone and corona are restricted to levels lower than the temperature maximum and the solar wind models begin above it. The authors study a self-consistent oversimplified model which maintains the global balance of energy sources and sinks from the chromospheric level to the interplanetary medium. The heating mechanism chosen is the shock wave dissipation. The model includes self-consistently the different coupling between convective energy flux, conductive flux, radiative losses in optically thin atmosphere, shock wave pressure and dissipation terms. The input parameters are the base pressure, the base temperature and the mechanical flux introduced at chromospheric level in form of shock waves. If these three parameters allow a solar wind expansion, the output results are the radial variations of the density, of the temperature, of the solar wind velocity and of the mechanical flux.

1305 **Reflexion and transmission of Alfven waves in an atmosphere.** Bel, N.; Leroy, B. (Observatoire de Paris, Section de Meudon, 92 (France)). pp 131-133 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

To study the transfer of energy by waves through a stellar atmosphere, its reflectivity with respect to each of the three MHD modes is needed. The authors consider linear Alfven waves only.

1306 **Solar radar observations.** Benz, A.O. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). pp 135-138 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

1307 **Mode-coupled MHD waves in the corona and solar wind.** Heinemann, M. (Boston Coll., Chestnut Hill, MA (USA). Dept. of Physics); Olbert, S. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). pp 139-141 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors outline a model of mode-coupled MHD compressional waves in the corona and solar wind. The eventual aim of this work is to be able to compute how MHD waves propagate through the corona and into the solar wind beginning with a source of Alfven or fast mode waves at the base of the corona. The necessity for consideration of mode coupling arises because of typical scalelengths in the corona. For wave sources, such as supergranulation, with wave periods of about a day, the different modes do not propagate independently, as in the WKB approximation, but are coupled because the ratio of wavelength to scalelength is of the order of one or greater.

1308 **Properties of magnetohydrodynamic turbulence in the solar wind.** Dobrowolny, M. (Consiglio Nazionale delle Ricerche, Frascati (Italy). Lab. per il Plasma nello Spazio); Mangeney, A. (Observatoire de Paris, Section de Meudon, 92 (France)); Veltri, P.L. (Dipartimento di Fisica, Universita della Calabria, Italy). pp 143-146 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The observations of MHD turbulence in the solar wind indicate that this is in a state characterized, to a good degree by the absence of non linear interactions. It is argued that this is a general property of incompressible MHD turbulence in a magnetized plasma.

1309 **Empirical relation between density, flow velocity and heliocentric distance in the solar wind.** Eyni, M.; Steinitz, R. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics). pp 147-150 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Solar wind flow quantities such as matter flux, momentum flux and energy flux, may be closely related to the mechanism responsible for the evolution of the solar wind. In the highly supersonic flow regime their study is facilitated by the fact that the contribution of thermal motions to the momentum and energy fluxes is negligibly small, and thus all three quantities are expressible in terms of proton density n and flow velocity u. If a relation between n, u and heliocentric distance r can be established, the study of these quantities is further simplified. The authors point out that such a relation does in fact exist, and comment on its implications.

1310 **Are solar wind measurements of different spacecraft consistent.** Steinitz, R.; Eyni, M. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics). pp 151-154 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Results of solar wind measurements by different spacecraft are not always in full accord. Such measurments are in general not from one and the same distance r from the sun, nor are they taken at the same phase of the solar activity cycle. One would like to be able to discriminate between spacecraft calibration effects on the one hand, and solar wind variations which reflect true spatial gradients or changing boundary conditions at the sun on the other hand. Accordingly the authors examine the possibility of reconciling the apparent discrepancies. First, density measurements are compared and their differences related to the velocities with which they have been sampled. Further, proton temperature gradients obtained from Helios 1 and Mariner 2 are compared and it is suggested that the different results are due to stream-stream interactions in the solar wind. A brief summary of the more obvious as well as the subtle effects velocity sampling has on the evaluation of some solar wind parameters and their gradients is given.

1311 **Observation of dust generated hydrogen in the solar vicinity.** Fahr, H.J.; Ripken, H.W.; Lay, G. (Bonn Univ. (Germany, F.R.). Inst. fuer Astrophysik und Extraterrestrische Forschung). pp 155-158 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Solar wind protons impinging on interplanetary dust grains are trapped, deionized, and subsequently desorbed. The steady state distribution of desorbed neutral hydrogen inside of 0.4 AU can be deduced by observation of resonantly scattered solar 121.6 nm radiation. Calculated integral intensities and spectral profiles are given, showing the clear spectral separation of the different radiation components. Given a specific solar wind proton flux, the interplanetary dust distribution can be determined. Conversely, dust density profiles from zodiacal light measurements can be used to deduce solar wind proton fluxes at heliocentric distances of 0.4 to 0.15 AU. Observations of latitudinal and short-term temporal proton flux variations seem feasible.

1312 **Model calculations of solar wind expansion including an enhanced fraction of ionizing electrons.** Petelski, E.F.; Fahr, H.J.; Ripken, H.W. (Bonn Univ. (Germany, F.R.). Inst. fuer Astrophysik und Extraterrestrische Forschung). pp 159-162 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Collective interactions of the solar wind and newly ionized interstellar gas cause turbulent electron heating to ionizing energies analogous to laboratory experiments on the critical ionization velocity effect. Implications for solar wind and interstellar gas dynamics are calculated by simultaneously solving continuity equations for solar wind protons, interstellar hydrogen atoms, and energetic electrons. Electron impact ionization is shown to be practically as important as photoionization, giving rise to a stronger deceleration and heating of the distant solar wind, a weaker terminating shock, a smaller stand-off distance of the heliopause, and implying higher densities of the outer solar wind and the interstellar neutral gas.

1313 **Correlated variations of planetary albedos and solar-interplanetary parameters.** Lockwood, G.W.; Thompson, D.T. (Lowell Observatory, Flagstaff, AZ (USA)); Suess, S.T. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.). pp 163-166 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The brightnesses of Titan and Neptune have been monitored photoelectrically at 472 and 551 nm since 1972 at the Lowell Observatory, yielding annual mean magnitudes accurate to 0.3 percent (0.003 mag). Both objects increased steadily in brightness until 1976 and declined thereafter. The range of variation was about 0.08 mag for Titan and 0.03 mag for Neptune. This period of observation coincides with the decline of solar activity in cycle 20 and the subsequent rise in cycle 21. Because there is no evidence to suggest that the solar flux in the visible region varies by more than a small fraction of one percent, the authors hypothesize that some variable component of the solar output influences the albedos of Titan and Neptune. Correlation studies of the observed planetary brightness variations and various solar-interplanetary parameters have allowed the elimination of some of these as candidates for a cause-effect relationship but do not lead yet to a conclusive identification of the controlling parameter and the mechanism by which it operates upon planetary atmospheres.

1314 **Large-scale magnetic field structure at the Earth's orbit, its correlation with solar activity and orientation and motion of the solar system in the Galaxy.** Vassileva, G.J.; Kuznetsova, M.A.; Kotlyar, L.M. (AN SSSR, Leningrad. Glavnaya Astronomicheskaya Observatoriya). pp 167-172 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Interplanetary magnetic field data from the different satellites obtained during the period 1963-1973 at 1 A.U. and compiled by J. King have been analysed in heliocentric ecliptic coordinates. The peculiarities of the background interplanetary magnetic field (BIMF) are discussed in relation to the orinetation of the solar system in the Galaxy and the variable helioefficiency of the planets. The results of the direct cosmic experiments are evidence of the solar activity being a complex phenomenon of the solar system as a whole.

1315 **Energy and mass injected by flares and eruptive prominences.** Engvold, O. (Oslo Univ. (Norway). Inst. for Teoretisk Astrofysikk). pp 173-188 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The dynamic nature of the outer corona has been revealed in recent years by improved techniques of studying the corona with ground based instruments and from space. Rapid changes in the coronal brightness pattern takes the form of mass ejections in which the outward moving material generally appears to escape the Sun. These events are called coronal transients. Observations have shown that the excess mass and energy in coronal transients are supplied by material expelled from the chromosphere and lower corona in conjunction with Hα surface activity. The transients are the coronal response to release of mass and energy which are manifested by flares and eruptive prominences. The author attempts to evaluate the significance of these dynamic events with regard to coronal disturbances.

1316 **X-ray evidence of coronal preflare emission.** Webb, D.F. (American Science and Engineering, Inc., Cambridge, MA). pp 189-193 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Flares are believed to derive their energy from localized nonpotential magnetic fields; this energy is somehow stored and initially released in the low corona. Therefore, knowledge of coronal conditions prior to flares is essential to the understanding of the flare process. The coronal plasma is constrained by the magnetic field and its characteristic emission is easily observed at soft X-ray wavelengths. Therefore, X-ray imagery is well suited for observing changes in emission influenced by nonpotential magnetic fields in the low corona. This study used soft X-ray images from the Skylab

AS and E telescope to search for evidence of coronal preflare emission.

1317 **Spicules and macrospicules.** van Tend, W. (Rijksuniversiteit Utrecht (Netherlands). Sterrewacht Sonnenborgh). pp 195-197 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The transition zone overheating model and the melon seed model are compared with observations of spicules, macrospicules, surges and sprays.

1318 **UV emitting spicules.** Poletto, G. (Osservatorio Astrofisico di Arcetri, Florence (Italy)). pp 199-201 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Extreme ultraviolet observations of the chromospheric network in a coronal hole obtained in 1973 by the Harvard College Observatory experiment aboard Skylab are analyzed. Upper and lower limits to the actual emission measure in UV spicules have been obtained, and the consistency of the derived values with the hypothesis that UV spicules are Hα spicules falling back after being heated is discussed.

1319 **Peculiar type of filament activation.** Bruzek, A. (Kiepenheuer Institut, Freiburg (Germany, F.R.)). pp 203-206 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Hα observations of a peculiar type of filament activation are presented and discussed. Ejected filament material was stopped at a distant position and formed a new stable filament for 1/2 - 1 hour until it returned to its source or faded in situ. A similar event has been observed at the solar limb.

1320 **Filament eruption in the 3B flare of July 29, 1973: onset and magnetic field configuration.** Moore, R.L.; LaBonte, B.J. (Hale Observatories, Pasadena, CA (USA)). pp 207-211 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors present direct observational evidence for the preflare magnetic field configuration, the nature of the filament destabilization and triggering of the flare, and the magnetic field configuration after the filament eruption in the large, well-ordered, expanding two-ribbon flare of July 29, 1973.

1321 **Dynamics of a quiescent filament.** Schmieder, B.; Martres, M.J.; Mein, P.; Soru-Escaut, I. (Observatoire de Paris, Section de Meudon, 92 (France)). pp 213-215 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors present some results concerning the dynamics of quiescent filaments. Observations with the Meudon Heliograph in three wavelengths in the Hα line have already shown two kinds of perturbations: (1) a fast one lasting about 10 minutes and (2) a slow one which lasts a few hours. These qualitative observations have been completed recently with the Multichannel Subtrative Double Pass Spectrograph (MSDP) which operates on the Solar Tower in Meudon. This instrument allows a good spatial and temporal resolution which gives quantitative results. The authors have obtained observations in the Hα line of a quiescent filament on October the 11th 1977 (set of observations during 4 minutes with a 20 seconds sample) and on October the 13th 1977.

1322 **Particle acceleration in the process of eruptive opening and reconnection of magnetic fields.** Svestka, Z. (Rijksuniversiteit Utrecht (Netherlands). Lab. voor Ruimte-Onderzoek); Martin, S.F. (San Fernando Observatory, CSUN, CA (USA)); Kopp, R.A. (Los Alamos Scientific Lab., NM (USA)). pp 217-221 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors discuss the flare of 29 July 1973, and present a model to explain the observed Hα post-flare loops. An important feature of this model is that particle acceleration would be a long-enduring process with the most rapid acceleration occurring during the flash phase of the flares, but with continued acceleration and injection occurring throughout the whole flare life.

1323 **Thermalisation of flare-time energetic electrons observed at radio and X-ray wavelengths.** Degaonkar, S.S.; Sawant, H.S.; Bhonsle, R.V. (Physical Research Lab., Ahmedabad (India)). pp 223-226 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

An interesting microwave event at 2800 MHz was recorded at Ahmedabad on September 19, 1977 at 1026 UT at the same time as the H-Alpha solar flare of importance 3B. The microwave burst was of impulsive nature, with as many as twenty impulses in seventy minutes with a quasi-periodicity of 1 to 5 minutes. An X-ray burst recorded by GOES Satellite in 1-8A band showed at the same time a smooth soft X-ray profile with apparently no sign of hard X-ray bursts. This indicates that the acceleration of discrete electron streams which produced impulsive microwave bursts was not sufficient to produce the hard X-ray component but got thermalised to

produce soft X-ray emission, with a gradual rise and a slow decay covering a long duration of more than 2.5 hours.

1324 **Recent observations of energetic electrons in solar flares.** Kane, S.R. (California Univ., Berkeley (USA). Space Sciences Lab.). pp 227-230 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

So far it has not been possible to measure unambiguously the spectrum of impulsive X-rays < approximately 10 keV and hence to deduce a possible low energy cut-off in the energetic electron spectrum. The author reports briefly such an observation made with the ISEE-3 X-ray spectrometer experiment and its implications with regard to the characteristics of energetic electrons in solar flares.

1325 **Energy storage process and energy budget of solar flares.** Tanaka, K. (Tokyo Univ., Mitaka (Japan). Tokyo Astronomical Observatory); Smith, Z. (Tokyo Univ. (Japan)); Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). pp 231-234 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The flare energy is generally considered to be stored in stressed (twisted or sheared) magnetic fields. Chatacteristic magnetic configurations in the great activities (inverted, twisted delta-configuration) suggest an inherent shape of fluxtube for these regions: a twisted magnetic knot. Further, evolutionary characteristics such as rapid growths of spots and growth of twist in parallel with apparent shear motion of spot, together with the fact that the shear motion is associated with upward velocity, suggest a continuous emergence of such a twisted knot from below throughout the activity. In this model the flare energy may be supplied directly into the corona as the twisted portion of the fluxtube emerges out. The authors evaluate the energy supply for a very flare-rich and fast-evolved active region McMath 13043 (1974 July), and compare it with released flare energies (thermal and kinetic).

1326 **Flare associated eruptive prominence activity of February 1, 1979.** Bhatnagar, A.; Jain, R.M.; Jadhav, D.B.; Shelke, R.N. (Vedhshala Udaipur Solar Observatory, Udaipur (India)); Bhonsle, R.V. (Physical Research Lab., Ahmedabad (India)). pp 235-240 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Observations and analysis of solar flare activated ascending 'Fountain type' prominence of 1 February 1979 are presented. This 'Fountain' prominence rose to 180,000 km above the solar surface and gave rise to a number of ascending loops and helical structure. These 'helicals' are clear manifestation of magnetic field configuration. From these observations it is shown that, as the 'Fountain' prominence rises, it carries along with it the complex magnetic field which unfolds as prominence material expands into distinct magnetic field lines. Several type III radio bursts were also seen associated with this event. No type II or IV radio emission was reported.

1327 **Disruption of EUV coronal loops following a mass ejection transient.** Schmahl, E.J. (Maryland Univ., College Park (USA)). pp 241-244 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

A classical filament disruption/coronal transient event occurred on 10 January 1974. After the prominence liftoff, 'gradual' X-rays were recorded by Solrad 9. A white light coronal ejection, interpreted as a loop seen edge-on, followed. During the mass outflow, Hα loops formed at the original site of the prominence. The loops appeared also in EUV spectroheliograms, and rose rapidly before vanishing abruptly. During the disintegration of the loops the apices showed great enhancements and vertical spike structures. The overall behavior of this loop prominence system is compatible with reconnection models.

1328 **Decameter radio and white light observations of the 21 August 1973 coronal transient.** Gergely, T.E.; Kundu, M.R. (Maryland Univ., College Park (USA)). pp 245-249 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Observations from SKYLAB have shown that coronal transients, which involve mass ejections occur quite frequently, possibly up to three times a day at solar maximum. An estimated mass of approximately $10^{15}$ - $10^{16}$ g and a total mechanical energy in excess of $2 \times 10^{31}$ ergs is expelled from the Sun during each event. The transients therefore play a major role in the dynamics of the outer corona and of the interplanetary medium. Joint radio and white light observations provide the best opportunity to derive the physical parameters, such as the electron density and magnetic field in different parts of the transients, and consequently to estimate the forces driving the ejecta.

1329 **Radio data and computer simulations for shock waves generated by solar flares.** Maxwell, A. (Harvard Coll. Observatory, Cambridge, MA (USA)); Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.). pp 251-255 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Solar radio bursts of spectral type II provide a prime diagnostic for the passage of shock waves, generated by solar flares, through the solar corona. In this investigation the authors compare radio data on the shocks with computer simulations for the propagation of fast-mode MHD shocks through the solar corona.

1330 **Estimation of shock thickness from dynamic spectra of type II bursts.** Sawant, H.S.; Degaonkar, S.S.; Alurkar, S.K.; Bhonsle, R.V. (Physical Research Lab., Ahmedabad (India)). pp 257-259 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Twenty type II solar radio bursts were observed during the period 1968 to 1972 by a solar radio spectroscope (240-40 MHz) at Ahmadebad. Intensity variations in type II bursts as a function of frequency and time are sometimes observed in their dynamic spectra. This fine structure enables determination of the shock thickness of the order of a few hundred to a few thousand kilometers. In a few cases, an interaction evidenced by simultaneous observations of short duration narrow band structures in type III bursts and type II bursts.

1331 **Evidence for open field lines from active regions: short communication.** Sheridan, K.V. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). pp 261 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

1332 **Flare model with force-free fields and helical symmetry.** Callebaut, D.K. (Physics Department, U.I.A., Universiteit Antwerpen, Universiteitsplein 1, Wilrijk-Antwerpen (Belgium)). pp 279-282 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Physical arguments are given indicating that solar flare magnetic energy storage may happen through force-free fields with helical symmetry. The mathematical results turn out simple for helical fields whether general, in equilibrium or force-free. A preliminary stability analysis points to appropriate properties.

1333 **False equilibrium of a force-free magnetic field.** Low, B.C. (Lau Kuei Huat (S) Pte. Ltd., 55 Shipyard Road, Singapore). pp 283-289 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

It has been a customary assumption that any force-free magnetic field represents an equilibrium field in the solar atmosphere under the extreme condition $8\pi p/B^2 << 1$. An example of a force-free magnetic field is presented for which this assumption fails in the sense that no equilibrium is possible for the magnetic field if imposed with an arbitrary ambient pressure, however weak the pressure is. A simple mechanism is proposed for the onset of eruption in the course of otherwise quasi-static evolution of magnetic fields in the solar atmosphere.

1334 **Energy storage and instability in magnetic flux tubes.** Sakurai, T. (Tokyo Univ. (Japan)). pp 291-294 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

It is known that the solar corona consists of many loops which are believed to represent the structure of the magnetic field. Since the plasma is very tenuous in the corona, the equilibrium of the magnetic field is approximated by the force-free field. The author proposes a method of solution for this and discusses the energy build up and instability in the magnetic flux tubes.

1335 **Filament instability in a sheared field.** Chiuderi, C. (Florence Univ. (Italy)); Van Hoven, G. (California Univ., Irvine (USA). Dept. of Physics). pp 295-298 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Filaments and prominences are classical examples of condensations of nongravitational origin, their formation being due to the thermal instability. The authors summarize the results of a self-consistent calculation of this instability in a non-uniform field, showing how the dynamic response of density and temperature to the competing effects of optically-thin radiation and field-collimated thermal conduction leads to the formation of characteristic 'knife-blade' filaments.

1336 **Model for impulsive electron acceleration to energies of tens of kTsub(e).** Hoyng, P.; Duijveman, A.; Grunsven, Th.F.J. van (Rijksuniversiteit Utrecht (Netherlands). Lab. voor Ruimte-Onderzoek); Nicholson, D.R. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). pp 299-302 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors describe a model for first stage electron acceleration based on quasi-linear interaction with Langmuir waves. The acceleration takes place in a MHD-unstable plasma region that contains many microscopically unstable current layers, which act as (quasi-stationary) sources of Langmuir waves.

1337 **Model flare and the continued post-flare mass release from the flare region.** Uchida, Y. (Tokyo Univ., Mitaka (Japan). Tokyo Astronomical Observatory). pp 303-306 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

A mechanism for slow and enduring mass release well after the flare onset, which is inferred from the enduring enhancement in the interplanetary mass flux after flare activity, is discussed in the modified scheme of a 'neutral sheet' model of flares. According to a possible new way of looking at the neutral sheet model, it is argued that a slow and enduring mass release in the later phase of a flare may come from the reconnection in the region of interleaved opposite polarity fields produced in the interchange collapse which is proposed to be responsible for the highly dynamical phase at the start of a flare. Heated plasma, which is magnetically disconnected from the anchoring field in the photosphere through reconnection in this interleaved region, is continuously produced during the thermal phase, and is expelled from the flare region by the 'buoyancy' in the gradient of the surrounding high magnetic pressure. The trajectory of this mass leakage will be along the steepest gradient of magnetic pressure, rather than along the field lines as expected in other picture, and this process can supply mass to the solar wind in open field regions.

1338 **Model of surge.** Noci, G. (Osservatorio Astrofisico di Arcetri, Florence (Italy)). pp 307-311 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The author reports on the application of a siphon flow model to the late stage of a surge observed in the UV radiation by the S055 experiment on board Skylab. The Mg X lambda625 and O VI lambda1032 emissions from the density distributions occurring in flows which become supersonic at the top of the loop agree with the observations, indicating a pressure drop, along the loop, of a factor of 4 for the plasma emitting the O VI line, and of a factor of 2 for the plasma emitting the Mg X line.

1339 **Radiative hydrodynamics of flares: preliminary results and numerical treatment of the transition region.** McClymont, A.N.; Canfield, R.C. (California Univ., San Diego, La Jolla (USA). Dept. of Physics). pp 313-316 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors report on a comprehensive numerical simulation of flare dynamics, encompassing the corona, transition region and chromosphere. A coronal loop geometry, whose magnetic pressure dominates gas pressure, is assumed. These preliminary results assume optically thin radiation. Difficulties in modelling the transition region under flare conditions are discussed, and tentative solutions are suggested.

1340 **Reconnection driven coronal transients.** Pneuman, G.W. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). pp 317-321 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The association of coronal transients with two-ribbon solar flares is well established. During the Skylab period, every two-ribbon flare when observed close enough to the limb was accompanied by a coronal transient. Flares do not occur with all transients, however many of these transients are associated with soft X-ray enhancements in the corona similar to but less energetic than the intense X-ray loops that occur with two-ribbon flares. The eruption of a filament seems to be the ingredient common to all these events - more so than flares. For these reasons, the author considers this class of phenomena, regardless of whether a flare occurs or not, to be exhibiting a common physical process. To produce chromospheric emission requires a substantial amount of energy. Hence, one should expect chromospheric flares to be associated with only the most energetic phenomena. Nevertheless, the most comprehensive observations covering a wide range of wavelengths (H$\alpha$, EUV, X-ray, radio, white light) are available for the large two-ribbon flares, and the study of these events sheds the most light on the mechanism which produces coronal transients.

1341 **Propagation of an MHD shock in the vicinity of a magnetic neutral sheet.** Mullan, D. J. (Bartol Research Foundation of the Franklin Institute, University of Delaware, Newark, DE (USA)); Steinolfson, R.S. (Alabama Univ., Huntsville (USA)). pp 323-326 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The acceleration of solar cosmic rays in association with certain solar flares is known to be highly correlated with the propagation of an MHD shock through the solar corona. The spatial structure of the sources of solar cosmic rays will be determined by those regions of the corona which are accessible to the flare-induced shock. The regions to which the flare shock is permitted to propagate are determined by the large scale magnetic field structure in the corona. It is known that helmet streamers overlie quiescent filaments, and these helmet streamers contain large magnetic neutral sheets which are oriented essentially radially. Hence the magnetic field structure in the low solar corona is characterized by a large-scale radial neutral sheet which weaves around the entire sun. There is therefore a high probability that as a shock propagates away from a flare, it will eventually encounter this large neutral sheet. The authors have studied the encounter between a finite amplitude wave and a neutral sheet, using a two dimensional MHD code in which the solar atmosphere is treated as a single fluid of polytropic index $\gamma$. Radiation is neglected, and there is no dissipation (except at shocks). As an initial state, solar gravity was neglected.

1342 **Two-fluid theory of interplanetary shock waves.** Rosenau, P. (Technion-Israel Inst. of Tech., Haifa). pp 327-331 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

A 2-fluid time-dependent analytical model of the perturbed solar wind is presented. The expansion of newly emitted material, caused, for instance, by the outburst of a solar flare, is simulated by a spherical piston. For a given thermal conductivity in the limit of strong coupling, one fluid flow in a thermally conducting medium is recovered. A pattern of flow which resembles one-fluid flow in adiabatic medium may be recovered if heat is removed from the perturbed plasma into the propelling plasma. The perturbed flow consists of a thermal precursor which is followed by a shock across which electrons are isothermal while protons are compressed and heated. Finally, it is shown that the post-shock rise and fall of density cannot be used to distinguish piston-driven waves from blast waves.

1343 **Transient disturbances of the outer corona.** Stewart, R.T. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). pp 333-355 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The author gives a brief review on observations of coronal transient disturbances followed by a detailed description of three events observed at radio and whitelight wavelengths, concentrating mainly on the radio evidence.

1344 **Transient phenomena originating at the Sun - an interplanetary view.** Intriligator, D.S. (University of Southern California, Los Angeles (USA)). pp 357-374 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

An overview is given of various phenomena observed by numerous spacecraft in the interplanetary medium. These phenomena are related to transient solar events such as flares and coronal holes. The effects of such transient solar events are extensive. At times, a solar event can affect the interplanetary medium out to distances as far as 17.2 AU and over a wide range of azimuthal angles. Also some phenomena, such as high frequency fluctuations (precursors of shocks) in the interplanetary medium, appear beyond 1 AU. Thus, transient phenomena are significantly modified by their passage through this medium. The conclusion is reached that transient events originating on the sun and passing through the interplanetary medium represent complex and significant physical problems.

1345 **Measurements of mass flow in the transition region and inner corona.** Rottman, G.J. (Colorado Univ., Boulder (USA). Lab. for Atmospheric and Space Physics). pp 375-378 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

A recent sounding rocket experiment has provided high spectral resolution line profiles across the solar disk. The objective of this experiment is to provide information on the systematic velocity fields at the base of the corona by observing the displacement, width and shape of EUV emission lines.

1346 **Association of type III bursts and coronal transient activity.** Jackson, B.V.; Dulk, G.A. (Colorado Univ., Boulder (USA)); Sheridan, K.V. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). pp 379-380 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Metric Type III radio bursts are nearly always associated with solar active regions. In particular, the occurrence of Type III bursts within a few minutes of the onset of the solar flares is well known. During the Skylab period, a broad peak in the number of isolated Type III bursts occurred about 5 h prior to large Hα solar flares. The authors follow up on a report that a peak in the number of isolated Type III bursts occurs prior to mass ejection transients observed from Skylab.

1347 **Recent very bright type IV solar metre-wave radio emissions.** Duncan, R.A.; Stewart, R.T.; Nelson, G.J. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). pp 381-385 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Moving Type IV solar metrewave radio outbursts with brightness temperatures between $10^8$ and $10^{10}$ K have been reported. The authors present Culgoora radioheliograph observations of four more Type IV radio sources, some moving, some stationary, but all with brightness temperatures above $10^9$ K, and one with a brightness temperature above $10^{13}$ K. Also one of the previously reported events (that of 1977 September 20) is described in more detail. The interest of these events is that their high brightnesses place great strain upon the gyro-synchrotron theory of radio emission.

**1348 Solar mass ejection of 8 May 1979.** Michels, D.J.; Howard, R.A.; Koomen, M.J.; Sheeley, N.R. Jr. (Hulbert (E.O.) Center for Space Research, Washington, DC (USA)); Rompolt, B. (Wroclaw Univ. (Poland). Obserwatorium Astronomiczne). pp 387-391 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The authors describe the main features of the 8 May 1979 solar mass ejection, including the eruption of a polar crown filament to 1.5 solar radii during 0810-1036 UT and the passage of material through the outer corona, from 2.6 to 10.0 solar radii, during 1028-1246 UT.

**1349 Variations of interplanetary parameters and cosmic-ray intensities.** Geranios, A. (Athens Univ. (Greece)). pp 393-398 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Observations of cosmic ray intensity depressions by earth bound neutron monitors and measurements of interplanetary parameter's variations aboard geocentric satellites in the period January 1972-July 1974 are analysed and grouped according to their correlation among them. From this analysis of about 30 cases it came out that the majority of the depressions correlates with the average propagation speed of interplanetary shocks as well as with the amplitude of the interplanetary magnetic field after the eruption of a solar flare. About one fourth of the events correlates with corotating fast solar wind streams. As the recovery time of the shock-related depressions depends strongly on the heliographic longitude of the causative solar flare, it seems that the cosmic ray modulation region has a corotative-like feature.

**1350 Two classes of fast solar wind streams: their origin and influence on the galactic cosmic ray intensity.** Iucci, N.; Parisi, M.; Storini, M.; Villoresi, G. (Rome Univ. (Italy). Ist. di Fisica). pp 399-401 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The analysis of solar wind and magnetic field data in the years 1964-1974 makes possible to identify two main classes of high-speed streams: a) Regular high-speed streams (RHSS's); and, b) Complex high-speed streams (CHSS's). The period during which the solar wind was emitted from the Sun is computed for each stream, by using speeds measured at the Earth assuming a constant Sun-Earth solar wind speed. The following features are obtained: nearly all (96%) the RHSS's are emitted during periods in which no 'strong active regions' (AR's) exist at the central meridian and no solar flares accompanied by type IV radioemission fairly well extended in time and frequency (type IV SF's) occur; nearly all (92%) the CHSS's are associable with AR's and with type IV SF's.

**1351 Large decametric wavelength antenna array for IPS observations of radio sources.** Sastry, C.V. (Indian Inst. of Astrophysics, Bangalore). pp 403 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

**1352 Interplanetary scintillation - preliminary observations at 103 MHz.** Alurkar, S.K.; Bhonsle, R.V. (Physical Research Lab., Ahmedabad (India)). pp 405-408 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

A 3-station interplanetary scintillation (IPS) observatory is being developed mainly with a view to study the solar wind plasma. This first IPS telescope operating at 103 MHz at Thaltej near Ahmedabad has been put into regular operation since April 1979. With only half the antenna aperture (approximately 2500 $m^2$) presently in use, observations of 8-10 sources are being made to calculate scintillation index, temporal spectrum of intensity fluctuations and scale size of density irregularities.

**1353 IPS observations of flare-generated disturbances.** Watanabe, T. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). pp 409-412 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Dynamical behaviour of a flare-generated disturbance can be followed by IPS observations through a comparison between the IPS observations and a model of the disturbance. The highly turbulent post-shock plasma can be attributed to the contact surface of the disturbance. Two examples of IPS observations of flare-generated disturbances are discussed.

**1354 Physical driving-forces and models of coronal responses.** Syrovatskii, S.I.; Somov, B.V. (AN SSSR, Moscow. Fizicheskij Inst.). pp 425-441 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The reasons for nonstationary hydrodynamic flows in solar atmosphere are reviewed. It is emphasized that a rapid local heating of corona or upper chromosphere can scarcely provide a very

large mass of solar plasma ejections observed in corona and interplanetary space. It is suggested that coronal transients and interplanetary ejections are produced by magnetic field evolving in solar atmosphere. Magnetic reconnection in current sheets can play essential role in this process. The suitable approximation of strong magnetic field is formulated. Some solutions of MHD equations in this approximation are demonstrated. Their applications to coronal conditions are discussed.

1355 **Theoretical interpretation of traveling interplanetary phenomena and their solar origins.** Wu, S.T. (Alabama Univ., Huntsville (USA)). pp 443-458 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Recent theoretical studies on Traveling Interplanetary Phenomena (TIP) and their relation or presumed relation to their solar origins are reviewed. An attempt is made to outline the theoretical studies in the context of mathematical methods and physical processes. The following alternative approaches are examined: analytical vs. numerical methods; magnetohydrodynamics vs. hydrodynamics; processes with or without dissipation; continuum (macroscopic) vs. the kinetic (microscopic) approach. In particular, the flare-generated interplanetary shocks are used as examples to illustrate these theoretical studies within the context of TIP. Some emphasis is placed on MHD wave propagation through the inner corona and its maturity to a fully-developed interplanetary shock. Further, their propagation and the disturbing effects on the solar wind are considered. Cases concerning the classification and characteristics of blast-produced shocks and long-lasting ejecta are also discussed in the context of numerical simulations.

1356 **Physical processes and models of interplanetary responses: suggested theoretical studies.** Cuperman, S. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). pp 459-474 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Three ways to improve the theory and therefore the understanding of the physical processes in the interplanetary medium (during both quiet and disturbed periods of solar activity) are suggested. They are: (1) the development and consequently the use of higher order moments (fluid) equations as well as of more realistic closure conditions and transport coefficients for the macroscopic description of the solar wind; (2) the undertaking of computer simulation experiments on the nonlinear collective relaxation process through particle-wave-particle interaction due to the plasma electromagnetic instabilities which may develop under conditions prevailing in the solar wind; and (3) the consideration of collective interactions in the evaluation of the transport coefficients, as deduced from the quasi-linear theory and computer simulation experiments, and their incorporation into the higher order moment equations.

1357 **Cross sectional magnetic profile of a coronal transient.** Bird, M.K.; Volland, H. (Bonn Univ. (Germany, F.R.)); Seidel, B.L.; Stelzried, C.T. (Jet Propulsion Lab., Pasadena, CA (USA)). pp 475-481 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The role of the magnetic field in a coronal mass ejection event has not been unequivocally defined, and may in fact be quite variable in view of the large variety of shapes and sizes of coronal transients. Measurements of the magnetic field associated with these events have thus far been inferred from simultaneously observed radio bursts, which provide no information on the direction of the field and are limited in spatial resolution. Substantial improvement in these two areas could be achieved by continuous monitoring of the Faraday rotation of a linearly polarized spacecraft signal during solar occultation. A coronal event traversing the line-of-sight would yield a characteristic profile in cross section, which would be of value for discriminating between the various models of coronal transients.

1358 **Evolution of coronal magnetic structures.** Steinolfson, R.S.; Wu, S.T. (Alabama Univ., Huntsville (USA)). pp 483-486 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Several classes or types of coronal transients are believed to originate near the solar surface at the base of pre-existing coronal magnetic loops. These loops often lie beneath an overlying open-field region in a typical coronal- or helmet-streamer configuration. Recent experimental results indicate that these pre-existing magnetic loops may be torn open by the explosive force of the solar phenomena responsible for the transient. Numerical solutions of the time-dependent, two-dimensional, dissipationless, MHD equations of motion are used to examine the formation of a coronal streamer magnetic structure and the evolution of the streamer following an explosive solar event in the closed-field region.

1359 **Magnetically driven motions in solar corona.** Somov, B.V.; Syrovatskii, S.I. (AN SSSR, Moscow. Fizicheskij Inst.). pp 487-489 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Solution of the nonlinear MHD problem of plasma flow in an increasing dipolar magnetic field is obtained in the approximation of a strong field. The distributions of plasma velocity, displacement, and density are calculated. The situation when the magnetic dipole is 'increased' by rapid process of magnetic reconnection or current sheet rupture is illustrated. Possible applications are discussed in connection with plasma ejections from chromosphere in corona.

**1360 Gasdynamics of impulsive heated solar plasma.** Sermulina, B.J.; Spektor, A.R. (AN Latvijskoj SSR, Riga. Radioastrofizicheskaya Observatoriya); Somov, B.V.; Syrovatskii, S.I. (AN SSSR, Moscow. Fizicheskij Inst.). pp 491-494 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Numerical solutions for the problem of hydrodynamic response of the inhomogeneous (exponential) atmosphere on impulsive heating by energetic electrons or by very high-temperature thermal fluxes are discussed.

**1361 Dynamics of coronal transients: two-dimensional non-plane MHD models.** Nakagawa, Y. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center); Wu, S.T.; Han, S.M. (Alabama Univ., Huntsville (USA)). pp 495-498 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Numerical results are obtained for non-plane MHD responses to a sudden energy release in a stratified model atmosphere. In agreement with observations, it is shown that after the energy release, the magnetic field affected by the energy release relaxes toward the potential configuration while the outer atmospheric fields increase its shear. Additional results suggest a new way of interpreting the energy storage and release in repeated flares.

**1362 Observations of interplanetary scintillation and a theory of high-speed solar wind.** Washimi, H.; Kakinuma, T.; Kojima, M. (Nagoya Univ. (Japan). Research Inst. of Atmospherics). pp 499-502 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

It has been confirmed that the high-speed solar wind flows out of the coronal holes at low latitudes, where the magnetic fields open and the temperature is low. But there has not been direct observation of the solar wind out of the polar regions of corona. The authors report that the observations of interplanetary scintillation (IPS) show the existence of the high-speed flow of 800 km/s out of the polar coronal regions and the well-coincidence to the model of the coronal holes extending from the polar regions.

**1363 Global modeling of disturbances in the corona-interplanetary space.** Yeh, T. (Metropolitan State College, Denver, CO (USA). Department of Mathematics). pp 503-506 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

In the past few years, numerical studies of corona-interplanetary dynamics have been undertaken by many investigators. The results indicate that this approach seems very promising and worthy of further pursuit. So far, the calculations have been performed on two-dimensional codes, to simulate magnetohydrodynamic flow in a meridional plane or in the equatorial plane. In order to fully account for the global features of the corona-interplanetary phenomenon, it is necessary to do three-dimensional calculations. The author discusses some groundwork for the formulation of a time-dependent three-dimensional code.

**1364 Program for the observations of the Sun and heliosphere from space 1980-1995.** Bohlin, J.D.; Chipman, E.G. (National Aeronautics and Space Administration, Washington, DC (USA)). pp 523-539 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

Recent, fundamental discoveries of the phenomena of the Sun and of interplanetary space have led to a far broader definition of the term 'solar physics' than was generally perceived a decade ago. The implications of this broadened definition of solar and heliospheric physics will be studied by essentially every solar space mission either now approved, or in the planning stage, for the period of 1980 to 1995. These missions include traditional Earth-orbiting satellites; Shuttle/Spacelab sortie missions, free flyers that transit the solar polar caps and probe the innermost corona (both frontier regions of the heliosphere), and finally possible semi-permanent orbiting platforms for advanced solar/heliosphere observations.

**1365 Proposal for an interplanetary mission to sound the outer regions of the solar corona.** Porsche, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Forschungszentrum Oberpfaffenhofen, Wessling); Volland, H.; Bird, K. (Bonn Univ. (Germany, F.R.)); Edenhofer, P. (Bochum Univ. (Germany, F.R.)). pp 541-545 of Solar and interplanetary dynamics. Proceedings of the IAU symposium no. 91 held in Cambridge, MA, USA, August 27-31, 1979. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.); Tandberg-Hanssen, E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center) (eds.). Dordrecht, Netherlands; D. Reidel (1980).

From International Astronomical Union symposium no. 91 on solar and interplanetary dynamics; Cambridge, MA, USA (27 Aug 1979).

The mission of HELIOS had been started in order to investigate in situ the innermost regions of the interplanetary space. The two space-craft achieved a perihelion of about 0.3 AU solar distance. The space-craft are standing in and near outer conjunction for a relatively long time. This gives the opportunity to investigate the Sun's corona by sounding using radio science means, i.e. evaluation of polarization, of signal propagation time, of Doppler shift, of spectral line width, etc. Unfortunately, this experiment has not, so

far, performed as had been desired. A proposal is given to overcome this difficulty.

1366 **Observation of galactic super-soft x-ray using the satellite K-9M-60.** Hayakawa, S.; Iwanami, H.; Kunieda, H.; Nagase, F. (Nagoya Univ. (Japan). Faculty of Science); Yamashita, H. pp 429-440 of Uchu kansoku shinpojiumu, Showa 54. Tokyo, Japan; Tokyo Univ., Inst. of Space and Aeronautical Science (Nov 1979). (In Japanese)

From Symposium on the cosmic observations; Tokyo, Japan (13 Jun 1979).

A part of the results obtained from the observation using K-9M-60 is presented. The excess in the energy region less than 0.1 KeV found in the energy spectra with the 0.5 μm PPL counter is described. The directional distributions of the L-band (0.15 to 0.3 KeV) and the LL band (0.06 to 0.15 KeV), and the energy spectra were obtained. The excess was seen in the energy spectrum of the LL band. The reason for this excess was considered and discussed. The noise spectrum of the counter is not a cause of the excess. As a result of discussion, it is suggested that the excess is due to other X-ray component with the energy less than L band. If this is true, the origin of the LL band X-ray may be a white dwarf or high temperature plasma.

1367 **Radio and x-ray observations of a multi-spike impulsive burst with high time resolution.** Kosugi, T. (Tokyo Univ., Mitaka (Japan). Tokyo Astronomical Observatory). pp 232-237 of IMS (International Magnetosphere Study) symposium, 1979. Tokyo, Japan; Tokyo University (Nov 1979).

From IMS (International Magnetosphere Study) symposium; Tokyo, Japan (12 Nov 1979).

A well-developed multi-spike impulsive microwave burst occurred together with a hard X-ray burst on February 17, 1979. Simultaneously a large group of type III bursts was observed at metric wavelengths. Detailed comparisons between these three classes of emission are made with high time resolution, and it can be pointed out that the whole event is composed of several subgroups of elementary spike bursts, and that each type III spike coincides in time with corresponding elementary X-ray and microwave spike bursts. The decay characteristic time scales of an elementary spike burst are $<<1$ sec, asymptotically equals 1 sec and asymptotically equals 3 sec for type III, hard X-ray and microwave emission respectively. Microwave source structure of one subgroup differs slightly from that of another subgroup, which suggests that the electron-accelerating region shifts its location after staying at one location for several tens of seconds, duration of a subgroup of elementary spike bursts. Several requirements which the above-mentioned observational facts pose upon a model of the impulsive phase are discussed.

1368 **Balloon observation of galactic gamma-ray lines.** Watanabe, H.; Yoshimori, M.; Okudaira, K.; Hirashima, Y.; Murakami, H. (Rikkyo Univ., Tokyo (Japan). Faculty of Science). pp 216-222 of Daikikyu shinpojiumu, Showa 53. Tokyo, Japan; Tokyo Univ., Inst. of Space and Aeronautical Science (Mar 1979). (In Japanese)

From Symposium on large balloons; Tokyo, Japan (21 Dec 1978).

1369 **Balloon observation of the galaxy australis in Australia.** Hayakawa, S.; Matsumoto, T.; Murakami, H.; Noguchi, K.; Uyama, K. (Nagoya Univ. (Japan). Faculty of Science). pp 231-238 of Daikikyu shinpojiumu, Showa 53. Tokyo, Japan; Tokyo Univ., Inst. of Space and Aeronautical Science (Mar 1979). (In Japanese)

From Symposium on large balloons; Tokyo, Japan (21 Dec 1978).

1370 **Atmospheric structure of the low-temperature stars.** Kodaira, K.; Tanaka, W.; Nakada, Y.; Onaka, T.; Watanabe, T. (Tokyo Univ. (Japan). Faculty of Science). pp 270-277 of Daikikyu shinpojiumu, Showa 53. Tokyo, Japan; Tokyo Univ., Inst. of Space and Aeronautical Science (Mar 1979). (In Japanese)

From Symposium on large balloons; Tokyo, Japan (21 Dec 1978).

1371 **Observation of soft x-ray and hard x-ray by the satellite Hakucho.** Ogawara, Y. (Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science). pp 163-168 of Kagaku eisei shinpojiumu. Tokyo, Japan; Tokyo Univ., Inst. of Space and Aeronautical Science (1979). (In Japanese)

From Symposium on the scientific satellite; Tokyo, Japan (24 May 1979).

Observation of X-ray burst by Hakucho has been made. Soft X-ray was detected by 4 detectors in the direction of spin axis and two detectors perpendicular to the axis. A detector for hard X-ray was placed in the direction of spin axis. With these detectors, correlation maps were constructed. Since April 7, 1979, Hakucho has watched bursts. Seven burst sources have been detected. Among them, the bursts with stronger intensity than previous ones were observed.

1372 **Observation of super-soft x-ray by the satellite 'Hakucho'.** pp 169-179 of Kagaku eisei shinpojiumu. Tokyo, Japan; Tokyo Univ., Inst. of Space and Aeronautical Science (1979). (In Japanese)

From Symposium on the scientific satellite; Tokyo, Japan (24 May 1979).

Observation of super-soft X-ray has been made for the purposes to watch X-ray sources, to measure the X-ray spectra and to observe the variation of the sources in course of time. A detector for the present observation is a thin window proportional counter, which was separated to two sections. In other words, two independent counters are combined together. These counters are gas-flow type counters. The energy range of observed X-ray is from 0.1 to 2 KeV. The observation started on Feb. 21, 1979. Analysis of the obtained data is in progress. A burst from the burster 1636-536 and the strong variable X-ray star GX 339-4 were detected. The increase of light of the nova type variable UGem was observed on March 23.

## 6402 Atmospheric Physics

1373 (ESA-SP—152, pp 21-29) **Auroral particle acceleration: an example of a universal plasma process.** Haerendel, G. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

The occurrence of discrete and narrow auroral arcs is attributed to a sudden release of magnetic tensions set up in a magnetospheric-ionospheric current circuit of high strength. At altitudes of several 1000 km the condition of frozen-in magnetic fields can be broken temporarily in thin regions corresponding to the observed width of auroral arcs. This implies magnetic field-aligned potential drops of several kilovolts supported by certain anomalous transport processes which can only be maintained in a quasi-stationary fashion if the current density exceeds a critical limit. The region of field-aligned potential drops is structured by two pairs of standing waves which are generalized Alfven-waves of large amplitude across which the parallel electric field has a finite jump. The waves are emitted from the leading edge of the acceleration region which propagates slowly into the stressed magnetic field.

1374 (ESA-SP—152, pp 117-118) **Positive ion composition in noctilucent clouds.** Kopp, E.; Eberhardt, P.; Herrmann, U. (Bern Univ. (Switzerland). Physikalisches Inst.); Bjoern, L. (Uppsala Univ. (Sweden). Astronomiska Observatoriet). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

1375 (ESA-SP—152, pp 243-255) **Wave-particle interactions in the high altitude auroral ionosphere.** Johnstone, A.D. (Mullard Space Science Lab., Dorking (UK)). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

It has been argued that wave-particle interactions cannot explain the differences between observed auroral electron distributions and those calculated for acceleration by a quasistatic, parallel electric field. Current knowledge of the non-linear effects associated with beam-plasma interactions is reviewed in order to find out how the electron velocity distributions would be modified. Many of the observed differences follow quite naturally from the general effects to be expected. There is no reason yet to reject the idea that auroral electrons are accelerated by a parallel electric field although more work is needed on detailed comparisons to confirm these conclusions.

1376 (ESA-SP—152, pp 257-262) **Electron spectra over discrete auroras as measured by the substorm-GEOS rockets.** Sandahl, I.; Eliasson, L.; Lundin, R. (Kiruna Geofysiska Inst. (Sweden)). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

Results from the first two Substorm-GEOS rockets are presented. These rockets, as well as the third one, were launched from ESRANGE on January 27, 1979 into different substorm phases. The first rocket went into an active pre-breakup evening arc and the second one into a breakup close to magnetic midnight. Electron spectra of downcoming particles measured by a narrow energy bandwith detector show very narrow energy peaks as soon as the integral energy fluxes are high. These peaks always show populations of two different characteristic energies above the peak energy. One of the populations has properties similar to those found in the boundary layer plasma and the other one seems to be of plasma sheet origin. The plasma sheet like population is also seen where there are no signs of energy peaks, for example equatorward of the arc. The boundary layer plasma is exclusively connected with the signatures of acceleration.

1377 (ESA-SP—152, pp 263-268) **Some results from the auroral particle experiment on board the barium-GEOS rocket.** Eliasson, L.; Lundin, R.; Sandahl, I. (Kiruna Geofysiska Inst. (Sweden)). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

The Barium-GEOS rocket was launched from Esrange 20.20:10 UT on September 24, 1979 during the expansion phase of a magnetic substorm. Electron and positive ion measurements were performed with detectors looking in different directions relative the rocket spin axis with high angular resolution (2 x 2°) in the energy range 70 eV - 21 KeV. Peaked electron energy spectra were observed during most of the flight. Highly collimated electron fluxes (within 10°) were often seen at the energy level just below the peak energy. Most of the observed features of the electron distribution are found to be consistent with an acceleration mechanism including a parallel potential difference. The characteristic energy is found to increase and the number density to decrease as the accelerating voltage increases. This is in good agreement with a theory predicting that the potential drop is built up as a consequence of a magnetospheric dynamo requiring a current of a certain magnitude to flow along the magnetic field lines.

1378 (ESA-SP—152, pp 279-284) **Sounding rocket observations of field-aligned current sheets.** Wilhelm, K. (Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.)); Kloecker, N.; Theile, B. (Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Geophysik und Meteorologie). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

A high-altitude sounding rocket payload was launched into an auroral break-up event from the Andoya Rocket Range on 13 October 1977. The payload encountered at least two well developed current sheets at the northern boundary of the auroral activity region. In the upward directed current regime, the charge carriers were predominantly precipitating energetic electrons embedded in a low-density, high-temperature magnetospheric plasma. The downward directed currents, on the other hand, were accompanied by a high-density, low-temperature plasma. Signatures of the current sheets could be identified in the perpendicular electric field as shock-like intensity and direction variations as well as in spectral modifications of high-energy electron and proton fluxes.

1379 (ESA-SP—152, pp 285-288) **Influence of energy diffusion on auroral particle distributions.** Hall, D.S. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

Observations of electrons precipitating from the Magnetosphere to the Ionosphere under a variety of auroral conditions suggest that the velocity distributions are formed by energy diffusion. Two possibilities are considered to account for the diffusion. It results either following electron acceleration through a potential difference, or as a consequence of plasma turbulence that accelerates electrons stochastically. It is found that the latter more readily accounts for the observations.

1380 (ESA-SP—152, pp 289-291) **Observation of an energetic proton beam and the generation of ULF-waves aboves active auroral forms.** Stuedemann, W.; Goertz, C.K. (Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.)). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

Measurements of nearly monoenergetic 65keV protons above active auroral forms were obtained on a rocket flight from Andenes (Norway) on October 13, 1977. Analysis of the pitch angle distribution of the >30keV protons and the azimuthal anisotopy of the proton fluxes support a model of a proton beam of finite spatial extent. The particle observations occur simultaneously with ULF-waves in the frequency range 0.5 to 5Hz. The particle distribution function is unstable to an amplification of obliquely propagating Alfven waves. We argue that the waves are amplified by resonant interaction with the proton beam.

1381 (ESA-SP—152, pp 479-496) **Middle atmosphere ionized component.** Arnold, F. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). Jun 1980. Dep. NTIS (US Sales Only).

From 5. ESA-PAC symposium on European rocket and balloon programmes and related research; Bournemouth, UK (14 Apr 1980).

The purpose of this paper is to review our current understanding of the middle atmosphere ionized component (hereafter MAIC) with an emphasis on in-situ composition measurement of electrically charged species. Concerning its typical structure which is characterized by a pronounced minimum of total charged particle concentrations around 60 km the MAIC can naturally be devided in two regions. The upper region extending from 60 to 100 km which covers the ionospheric D- (60 to 85 km) and lower E-regions (85 to 100 km) and which hereafter will be termed lower ionosphere results mainly from ionization of atmospheric gases by solar electromagnetic radiations. The lower region extending from the tropopause to 60 km which will be termed stratospheric ionized component results mainly from ionization by galactic cosmic radiation.

1382 (INIS-mf—6290, pp 56-57) **Long-period variations of cosmic rays in the stratosphere.** Okhlopkov, V.P. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1980. (In Russian). Dep. NTIS (US Sales Only).

In Cosmic and physical aspects of cosmic ray investigations. International seminar.

1383 (INIS-mf—6290, pp 68-69) **Observations of magnetospheric proton fluxes with energy more than 25 KeV in the interplanetary medium in March-April 1977.** Basilova, R.N.; Ryumin, S.P.; Stolpovskii, V.G.; Sharvina, K.N. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skii Inst. Yadernoj Fiziki). 1980. (In Russian). Dep. NTIS (US Sales Only).

In Cosmic and physical aspects of cosmic ray investigations. International seminar.

1384 (INIS-mf—6290, pp 74-75) **Change of a time profile in solar cosmic ray events during magnetic storms.** Pereyaslova, N.K.; Nazarova, M.N.; Petrenko, I.E. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Cosmic and physical aspects of cosmic ray investigations. International seminar.

## 6403 Atomic, Molecular, And Chemical Physics

*REFER ALSO TO CITATION(S) 676, 729, 1643*

1385 **Positronium formation in aqueous micellar solutions, (1).** Handel, E.D.; Ache, H.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemistry). pp 337-341 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

1386 **New developments in positron and positronium chemistry.** Ache, H.J. Blacksburg, VA; Virginia Polytechnic Institute and State University (1979). 18p.

In this review an attempt will be made to critically assesses the present status of positron and postronium chemistry. Recent experimental results in liquid systems and solutions obtained by several research groups will be discussed and interpreted in terms of various existing models for positronium formation. The different parameters which are thought to be responsible for inhibition or enhancement of positronium formation will be delineated and their relative contributions to the overall effect evaluated. In the second part of the paper the various types of reactions which positrons and positronium atoms can undergo will be demonstrated by the discussion of typical reactions with various reactants in liquid systems and their implications for conventional chemistry assessed. Finally, the third section of this talk will be devoted to the discussion of the application of the positron annihilation technique to the solution of pertinent chemical problems. Selected examples from the fields of physical-, micellar-, and biochemistry where this nuclear probe has been successfully employed have been chosen to demontrate the potential use of this technique in the various areas of chemistry.

1387 **High-current ion implanter for industrial use.** Sakudo, N.; Tokiguchi, K.; Koike, H.; Kanomata, I. (Hitachi Ltd., Kokubunji, Tokyo (Japan). Central Research Lab.). pp 36-41 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A microwave ion source based on a Van de Graaff accelerator and previously developed by the authors for ion implantation use, which has a long lifetime and low gas consumption even for high-current operation, has now been improved by extending its lifetime. Results are reported of applying the high-current ion implanter to an actual semiconductor production line.

1388 **New dose control technique for ion implantation.** Ryding, G.; Farley, M. (Nova Associates, Beverly, MA (USA)). pp 100-105 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A new dose control technique for ion implantation is described. The system uses mechanical scanning of wafer batches and operates at beam currents in the range of 20 nA to 20 mA. Wafers are mounted on the face of a spinning disc which is translated across the stationary beam. The doping rate is determined by measuring the beam intensity transmitted by a precision aperture in the disc. Features of the technique are discussed with reference to the common problems of dose control and typical performance results are presented.

1389 **Multiply charged ion beams of solids from sputter duoPIGatrons.** Gilles, J.P.; Lejeune, C. (Centre National de la Recherche Scientifique, 91 - Orsay (France)). pp 297-303 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

The construction and performance of two sputter duoPIGatrons, for the production of multiply charged metal ions, have been investigated in order to determine a compromise between source lifetime and beam characteristics. The influence of the sputter voltage is reported on total beam intensity, collection current on the anticathode and beam composition.

1390 **Electron cyclotron resonance source for heavy multiply charged ions.** Dousson, S.; Geller, R.; Jacquot, B. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). pp 304-308 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A miniaturised two-stage ECR ion source (called MICROMAFIOS) is described. The ion source is based upon the principle of electron cyclotron resonance (ECR) and delivers multiply charged heavy particles including completely stripped light ions. The source is a small-scale SUPERMAFIOS and is made up of permanent samarium cobalt magnets.

1391 **Properties and discharge mechanisms of a saddle-field ion source.** Pomathiod, L.; Henry, D.; Arnal, Y.; Boswell, R. (Centre National de la Recherche Scientifique, 45 - Orleans-la-Source (France)). pp 309-315 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

Properties of a saddle-field ion source used as a hydrogen ion injector in a space plasma experiment are described. Discharge mechanisms are emphasised: oscillation of the electrons has been studied by means of the observation of the high-frequency emission spectra of the discharge. A simple model of the discharge has been developed by solving Laplace's equations for the source geometry. This model enables calculation of the trajectories of the electrons in the potential well, the frequency of their oscillatory motion, their energy along their run and their mean free path at low pressure.

1392 **Liquid metal field-emission ion sources and their applications.** Prewett, P.D.; Jefferies, D.K. (UKAEA Culham Lab., Abingdon). pp 316-321 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

The study of ion emission from liquid metal surfaces under the action of high electric fields has led to the development of ion sources of exceptionally high brightness. The design and operating characteristics of commercially manufactured sources of gallium and gold ions are described. Preliminary focusing and scanning ex-

periments have produced spots estimated to be approximately 0.5 μm diameter at currents approximately 0.2 nA using an electrostatic ion optical system. A focused $Ga^+$ beam has been used as an ion microprobe for imaging and for elemental mapping of surfaces by SIMS.

1393 **Improvement of multiply charged ion production for pulsed duoplasmatron of duoPIGatron.** Lejeune, C.; Gilles, J.P. (Centre National de la Recherche Scientifique, 91 - Orsay (France)). pp 322-327 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A study of the operation of duoplasmatron and duoPIGatron ion sources has shown a decrease of the percentage of multiply charged ions in the beam when the duty cycle of the pulsed operation is decreased, resulting from the decrease in the pressure gradient which normally sets up between the cathode and anode compartments. A solution to this phenomenon which consists in providing an auxiliary pump-out of the gas in the anode compartment, the gas being initially injected in the cathode compartment, is illustrated by investigating the resulting improvement of the multiply charged ion production in the case of a duoPIGatron source.

1394 **Proton source for the high-intensity Lamb-shift-type polarised ion source.** Isoya, A.; Inoue, T. (Kyushu Univ., Fukuoka (Japan). Faculty of Science). pp 328-332 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A powerful proton source is described which has been manufactured and tested for a Lamb-shift type polarised ion source which is being constructed with the aim of obtaining an output of several μA. A dense narrow plasma is produced by the duoplasmatron and PIG discharge mechanism in a quartz capillary tube to which a strong magnetic field is applied along the tube axis and an ion current of several hundred mA with a high proton percentage (approximately 90%) is obtained from a narrow exit hole at the closed end of the quartz tube.

1395 **High-current DC heavy-ion source.** Shubaly, M.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). pp 333-338 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

A stable and efficient source for high-current beams of argon, nitrogen and xenon is described consisting of two units, a plasma source (duoPIGatron) and a multi-aperture accel- decel extraction column. The effects on beam current and ion source performance and stability, of changes in the intermediate electrode nose geometry, are described. It is reported that well defined beams with energies in the range 30 to 35 keV and with currents of 150 mA of argon, 190 mA of nitrogen or 98 mA of xenon have been produced.

1396 **Pressure dependence and stability of the extracted ion current in arc-discharge-type heavy-ion sources.** Pasztor, E. (Central Research Institute for Physics, Budapest (Hungary)). pp 345-351 of Low-energy ion beams, 1980. Invited and contributed papers presented at the second international conference on low-energy ion beams held at the University of Bath, 14-17 April 1980. Wilson, I.H.; Stephens, K.G. (eds.). Bristol, England; Institute of Physics (1980).

From International conference on low energy ion beams 2; Bath, UK (14 Apr 1980).

Investigations of the relationships between the parameters which affect the stability of the extracted ion current in arc-discharge-type heavy-ion sources with indirect heating and working in the mA range have been carried out. It has been found that with the working pressure kept a little (1 - 2 %) higher than the optimum value (due to the maximum extracted current at given source parameters) a +-10% instability in arc current does not cause more than a +-2% instability in the analysed target current. In one working mode of the source the changes in chamber pressure are proportional to the changes in target current and therefore the pressure must also be kept as constant as possible.

1397 **Molecular physics and quantum chemistry: into the 80's.** Burton, P.G. (ed.). Wollongong, Austrailia; Universty of Wollongong (1980). vp. (CONF-800283—).

From Conference on molecular physics and quantum chemistry; Sydney, Australia (17 Feb 1980).

The papers presented are entered in the data base separately. (WHK)

1398 **Charge transfer cross sections of $Ne^+$ and $Ne^{++}$ in rare gases.** Nakai, Y.; Kase, M.; Ozawa, K.; Shirai, T.; Kikuchi, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). pp 145-147 of 16th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Yota; Ozawa, Kunio; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From International seminar on ion-atom collisions (ISIAC VI); Tokai-mura, Japan (6 Sep 1979).

1399 **Kβ/Kα intensity ratios and energy shifts of Kβ rays produced by N-ion impact.** Mukoyama, T. (Kyoto Univ., Uji (Japan). Inst. for Chemical Research); Sarkadi, L.; Berenyi, D.; Koltay, E. pp 16-18 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1400 **K, L and M shell ionizations in the energy region E/lambda U > 1.** Sera, K.; Ishii, K.; Morita, S.; Kamiya, M.; Kuwako, A. (Tohoku Univ., Sendai (Japan)). pp 19-22 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1401 **Inner shell ionization in the collision system of $Z_1 << Z_2$.** Shima, K. (Tsukuba Univ., Sakura, Ibaraki (Japan). Tandem Accelerator Center). pp 23-26 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1402 **K-shell ionization of gold by electron and positron impact near the threshold energy.** Ito, S.; Kawaratani, T.; Kubota, K.; Shimizu, S. (Kyoto Univ., Uji (Japan). Inst. for Chemical Research). pp 28-29 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1403 **Multiple k-shell ionization of fluorine by hydrogen and helium ion impacts.** Kawatsura, K.; Ootuka, A.; Ozawa, K. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Fujimoto, F.; Komaki, K. pp 30-33 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1404 **Spectral shapes of the molecular autoionization caused by $Li^+$ + He collisions at energies lower than 1.1 keV.** Yagishita, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Wakiya, K.; Takayanagi, T.; Suzuki, H.; Koike, F. pp 34-36 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1405 **Measurements of double differential cross sections for electrons ejected by 5 - 20 keV $H^+$, $H_2^+$ and $He^+$ impacts on argon.** Sataka, M.; Urakawa, J.; Oda, N. (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor); Okuno, K. pp 37-40 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1406 **Recoil charge-state distributions resulting from small impact parameter collisions of F and O projectiles with Ne.** Cocke, C.L.; Gray, T.J.; Justiniano, E. (Kansas State Univ., Manhattan (USA)). pp 57-60 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1407 **Correlated two-electron transitions into doubly-ionized K-shell.** Safronova, U.I. (AN SSSR, Moscow. Inst. Spectroskopii); Senachenko, V.S. pp 61-64 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1408 **Dynamical effect on the ionization processes in ion-atom collisions.** Watanabe, T.; Woerlee, P.H.; Gordeev, Yu.S. (FOM-Instituut voor Atoom-en Molecuulfysica, Amsterdam (Netherlands)). pp 65-68 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1409 **Theory of inner-shell vacancy formation in superheavy quasimolecules.** Soff, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Reinhardt, J.; Betz, W.; Kirsch, J.; Mueller, B. pp 69-73 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1410 **K-Mo-radiation in heavy ion collisions.** Kirsch, J.; Betz, W.; Mueller, B.; Reinhardt, J.; Soff, G. (Frankfurt Univ. (Germany, F.R.) Inst. fuer Theoretische Physik). pp 79-82 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1411 **Positron production in heavy ion collisions.** Backe, H.; Bonin, W.; Engelhardt, W.; Kankeleit, E.; Mutterer, M. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). pp 83-86 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1412 **Inner shell ionization accompanied by electron bremsstrahlung.** Ishii, K.; Morita, S. (Tohoku Univ., Sendai (Japan)). pp 87-89 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1413 **Charge exchange with multicharged ions in slow collisions. Translation factors in a quantum mechanical formulation.** McCarroll, R. (Bordeaux-1 Univ., 33 - Talence (France)). pp 111-114 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1414 **Symmetric resonance electron transfer of multiply charged ions at low energies: A sup(+) + A → A + A sup(q+) (q <= 7).** Kaneko, Y.; Okuno, K.; Kobayashi, N. (Tokyo Metropolitan Univ. (Japan). Dept. of Physics); Iwai, T.; Ohtani, S. pp 115-116 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1415 **Contribution of electron transfer to K-shell ionizations by $N^{7+}$-ion bombardment.** Kamiya, M.; Kuwako, A.; Sebata, M. (Tohoku Univ., Sendai (Japan). Dept. of Physics); Ishii, K.; Morita, S. pp 117-120 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1416 **Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media.** Fukuzawa, F. (Kyoto Univ. (Japan). Faculty of Engineering). pp 141-144 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1417 **Charge transfer cross sections of $He^+$ and $Ne^+$ in carbon-containing molecules.** Nakai, Y.; Sataka, M.; Yagishita, A.; Ozawa, K.; Shirai, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). pp 148-149 of 6th international seminar or ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1418 **Electron capture and loss to, or from wake-riding states by fast ions in metals.** Kitagawa, M. (North Shore College, Atsugi (Japan). Dept. of Electronics); Ohori, T.; Ohtsuki, Y.H. pp 150-153 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1419 **Charge transfer in proton-hydrogenlike ion collision in a modified coulomb-born approximation.** Sil, N.C.; Sinha, C. (Indian Association for the Cultivation of Science, Calcutta. Dept. of Theoretical Physics). pp 154-157 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1420 **Collision processes involving excited atoms.** Nakamura, H. (Tokyo Univ. (Japan). Faculty of Engineering). pp 158-162 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1421 **Alignment and orientation in atomic collisions.** Macek, J. (Nebraska Univ., Lincoln (USA)). pp 163-166 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1422 **Excitation and ionization of He by the impact of fast, complex ions. Asymptotic energy and charge state dependence.** Gillespie, G.H. (Physical Dynamics, Inc., La Jolla, CA (USA)). pp 168-171 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1423 **Theoretical study of electron spectra ejected by molecular autoionization in He + $He^{2+}$ collision.** Sato, H. (Ochanomizu Univ., Tokyo (Japan). Dept. of Physics); Hara, S. pp 174-177 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1424 **Rotationally induced transitions in atomic collisions.** Namiki, M. (Tokyo Metropolitan Univ. (Japan). Dept. of Physics); Yagisawa, H.; Nakamura, H. pp 178-181 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1425 **Autoionization in multiply-charged ion-atom collisions.** Ogurtsov, G.N.; Mikoushkin, V.M.; Flaks, I.P. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). pp 182-186 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1426 **Alignment of ions after L- and M-shell ionization by proton impact.** Kocbach, L. (Bergen Univ. (Norway). Dept. of Physics). pp 188-190 of 6th international seminar on ion-atom collisions. Abstracts of invited and contributed papers. Nakai, Y.; Ozawa, K.; Tawara, H. (eds.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Research Committee of Atomic and Molecular Data). Tokai, Ibaraki; JAERI (Sep 1979).

From 6. international seminar on ion-atom collisions; Tokai, Ibaraki, Japan (6 - 7 Sep 1979).

1427 **Temperature dependence of sputtering rate of alkali halides by $Ar^+$ bombardment.** Ichinokawa, T. (Waseda Univ., Tokyo (Japan). School of Science and Engineering). pp 294-297 of Secondary ion mass spectrometry. Fundamentals and applications. Someno, M. (Tokyo Inst. of Tech. (Japan)); Wittru, D.B. Tokyo, Japan; Riaru-Kogeisha Ltd. (Mar 1979).

From 2. Japan-United States joint seminar on secondary ion mass spectrometry; Takarazuka, Hyogo, Japan (23 Oct 1978).

1428 **Application of multiple technique surface analysis to the study of preferential sputtering and other surface phenomena.** Phillips, B.F.; Johnson, W.C.; Zeller, M.V. (Physical Electronics Industries, Inc., Edina, MN (USA)). pp 298-301 of Secondary ion mass spectrometry. Fundamentals and applications. Someno, M. (Tokyo Inst. of Tech. (Japan)); Wittru, D.B. Tokyo, Japan; Riaru-Kogeisha Ltd. (Mar 1979).

From 2. Japan-United States joint seminar on secondary ion mass spectrometry; Takarazuka, Hyogo, Japan (23 Oct 1978).

1429 **Surface analyses of GaAs by ion beam backscattering method.** Kudo, H.; Ochiai, Y.; Takita, K.; Seki, S.; Masuda, K. (Tsukuba Univ., Sakura, Ibaraki (Japan)). pp 323-324 of Secondary ion mass spectrometry. Fundamentals and applications. Someno, M. (Tokyo Inst. of Tech. (Japan)); Wittry, D.B. Tokyo, Japan; Riaru-Kogeisha Ltd. (Mar 1979).

From 2. Japan-United States joint seminar on secondary ion mass spectrometry; Takarazuka, Hyogo, Japan (23 Oct 1978).

1430 **Positron interactions in gases.** Griffith, T.C. (University Coll., London (UK). Dept. of Physics and Astronomy). pp 517-526 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

A survey is given of the results obtained during the last two years on total cross-sections for positrons scattered in various gases using positron beams of well defined energies. Where possible comparisons are made with theoretical calculations. New developments are concerned with a determination of differential cross-sections for elastic scattering and on extracting the partial cross-sections for inelastic processes, particularly positronium formation, from the data. Some of the recent results from lifetime studies will also be discussed.

1431 **O-positronium pick-off quenching in dense gases, 1. Theoretical.** Tao, S.J. (New England Inst., Inc., Ridgefield, CT (USA)); Tseng, P.K.; Chuang, S.Y.; Chen, S.H. pp 551-555 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

1432 **O-positronium pick-off quenching in dense gases, 2. Experimental results in xenon and carbon dioxide.** Tseng, P.K.; Chuang, S.Y. (National Taiwan Univ., Taipei (Taiwan)); Chen, S.H.; Tao, S.J. pp 557-559 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

1433 **Positronium formation and thermalization of positrons in dense gases.** Tao, S.J. (New England Inst., Inc., Ridgefield, CT (USA)). pp 561-564 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

1434 **Density-functional theory of positronium bubbles in low-temperature classical fluids.** Nieminen, R.M. (Jyvaeskylae Univ. (Finland). Dept. of Physics); Manninen, M.; Vaelimaa, I. pp 565-568 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

1435 **Information on the state of electrons in liquids from positronium formation data.** Levay, B.; Mogensen, O.E.; Eldrup, M. (Risoe National Lab., Roskilde (Denmark)). pp 595-599 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

1436 **Doppler broadened annihilation radiation study in various liquid mixtures.** Okada, S. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment); Ito, Y.; Tabata, Y. pp 841-844 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

1437 **Positron-induced cluster and positronium bubble in low temperature helium.** Hautojaervi, P.; Rytsoelae, K. (Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics). pp 807-813 of Yo-denshi shometsu. Hasiguti, R.R. (Science Univ. of Tokyo (Japan). Faculty of Engineering); Fujiwara, K. (eds.). Sendai, Japan; Japan Inst. of Metals (1979).

From 5. international conference on positron annihilation; Lake Yamanaka, Japan (8 Apr 1979).

Both the positron and the positronium may exist in localized states in low temperature He-3 and He-4. The attractive polarization forces between a positron and helium atoms induce clustering of atoms around positrons. A striking feature is that this clustering occurs only below a critical temperature (droplet formation). Because of the exchange repulsion between helium atoms and positronium a cavity is formed in complete analogy with the electron bubble. New experimental results on bubble formation are presented. The structure of positron-induced clusters as well as of positronium bubbles can be successfully analyzed by the density functional theory of inhomogeneous fluids.

1438 **Experimental determination of the stable working region of a 15 cm-diameter RF-ion source 'RIT 15'.** Freisinger, J.; Loeb, H.W.; Reineck, S. (Giessen Univ. (Germany, F.R.). 1. Physikalisches Inst.). pp 703-704 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1439 **Yield of negative ions from the duoplasmatron plasma.** Ghander, A.M. (Atomic Energy Establishment, Cairo (Egypt)). pp 705-706 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1440 **Optimum design of the electrostatic electron oscillator.** Ghander, A.M. (Atomic Energy Establishment, Cairo (Egypt)). pp 707 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

## 6404 Fluid Physics

1441 (INIS-mf—6084, pp vp) **Quasiparticle and excitation energies of a condensed model bose system.** Dorre, P. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1980. Dep. NTIS (US Sales Only).

From Conference on the recent advances in statistical mechanics; Poiana Brasov, Romania (30 Aug 1979).

The single-particle and two-particle energies of a condensed Bose System (He II) are calculated from a purely microscopic theory involving a simple two-shell model potential for the two-particle interaction. Using a canonical transformation to quasiparticles together with Bogolyubov's variational principle, which corresponds to a temperature-dependent generalized Hartree-Fock approximation (HFA), integral equations for the Bose system are derived and solved self-consistently. The HFA of the density correlation function can be used as the lowest-order proper polarization part in a formal RPA for the polarization function yielding the excitation energies of the system. The lowest excitation energies are calculated numerically in the limit $\omega\tau >> 1$. In addition to the well-known "phonon-roton" spectrum a second branch is found.

1442 **Current-voltage behaviour of non-LTE pulse discharges.** Bohmeyer, W.; Guendel, H.; Seliger, K. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 627-628 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1443 **Influence of fluid-dynamic phenomena on the transverse electrical glow discharge.** Vorontsov, S.S.; Ivanchenko, A.I.; Shepelenko, A.A. (AN SSSR, Novosibirsk. Inst. Teoreticheskoj i Prikladnoj Mekhaniki). pp 631-632 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1444 **Critical field emission currents initiating vacuum breakdown for metals cooled up to liquid-helium temperatures.** Aksenov, M.S.; Baskin, L.M.; Zhukov, V.M.; Fursey, G.N. (Leningradskij Ehlektrotekhnicheskij Inst. Svyazi (USSR)); Fedorov, N.F.; Sharkova, O.P. (Leningradskij Politekhnicheskij Inst. (USSR)). pp 655-656 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1445 **Processes at cathode operating in regime of electron explosive emission.** Litvinov,. E.A.; Mesyats, G.A.; Proskurivsky, D.I.; Yankelevitch, E.B. (AN SSSR, Tomsk. Inst. Optiki Atmosfery). pp 657-658 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1446 **Minimum conditions for cathode erosion by electrical discharges in UHV.** Juettner, B. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 659-660 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1447 **Behaviour of carbon fibre cathodes in vacuum discharges.** Rohrbeck, W.; Juettner, B. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 661-662 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1448 **Influence of surface contamination on cathode erosion by nanosecond discharges in vacuum.** Siemroth, P.; Juettner, B. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 663-664 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1449 **Vacuum breakdown along a dielectric surface with an accumulated charge.** Avrutskii, V.A.; Koschienko, V.N. (Moskovskij Ehnergeticheskij Inst. (USSR)). pp 665-666 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1450 **Dependence of breakdown voltage on adsorbed gases.** Pokrovskaya-Soboleva, A.S.; Shapiro, A.L.; Razgulyaeva, V.I.; Borisova, T.S. (Vsesoyuznyj Ehlektrotekhnicheskij Inst., Moscow (USSR)). pp 667-668 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1451 **Phenomena taking place on the electrode surface in vacuum gap at high voltages.** Shapiro, A.L.; Pokrovskaya-Soboleva, A.S.; Razgulyaeva, V.I.; Mazyrova, L.K.; Zytchenko, L.N. (Vsesoyuznyj Ehlektrotekhnicheskij Inst., Moscow (USSR)). pp 669-670 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1452 **Current densities in anchored cathode spots of a dc mercury vacuum arc.** Eckhardt, G. (Hughes Research Labs., Malibu, CA (USA)). pp 671-672 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1453 **Interaction of vacuum arcs with transverse magnetic fields.** Emtage, P.R.; Gorman, J.G.; Heberlein, J.V.R.; Holmes, F.A.; Kimblin, C.W.; Slade, P.G.; Voshall, R.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). pp 673-674 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1454 **Anode spot ion currents and the interaction with axial magnetic fields.** Kimblin, C.W. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). pp 675-676 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1455 **Particle flux emitted from a vacuum arc.** Hermoch, V. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav); Djakov, B.E. (Bylgarska Akademiya na Naukite, Sofia. Inst. po Elektronika). pp 677-678 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1456 **Modified magnetron discharge facility.** Vana, J.; Bohacek, V.; Ripa, M. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). pp 679-680 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1457 **Electron density distribution in anode sheath of low pressure discharge in cross Esub(perpendicular)H fields.** Kervalishvili, N.A.; Korthondiia, V.P. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). pp 681-682 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1458 **Gas discharge investigation in crossed electric and magnetic fields.** Duvidzon, V.M.; Polyakov, Ye.A.; Fetisov, I.K. (Moskovskij Fiziko-Tekhnicheskij Inst. (USSR)). pp 683-684 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1459 **Discharge striking in axially symmetrical electric and magnetic fields.** Tyuryukanov, P.M.; Fetisov, I.K.; Khodachenko, G.V. (Moskovskij Fiziko-Tekhnicheskij Inst. (USSR)). pp 685-686 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1460 **Theory of discharge striking in highly inhomogeneous axially symmetrical magnetic field.** Tyuryukanov, P.M.; Fetisov, Y.K.; Khodachenko, G.V. (Moskovskij Fiziko-Tekhnicheskij Inst. (USSR)). pp 687-688 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1461 **Partially ionized gas in a travelling high frequency magnetic field.** Demirkhanov, R.A.; Doroshenko, A.N.; Zharikov, V.N.; Kadysh, I.J.; Kirov, A.G.; Minenko, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Sukhumi. Fiziko-Tekhnicheskij Inst.). pp 699 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1462 **Electron-beam sustained discharge in nitrogen.** Bronin, S.Ya.; Nizovsky, V.L.; Sushkin, V.N.; Shabashov, V.I.; Yartsev, Yu.V. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). pp 709-710 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1463 **Ion focusing of overneutralized electron beams in metal vapour.** Ledovskoy, V.P. (Leningradskij Ehlektrotekhnicheskij Inst. (USSR)); Seidowski, E. (Ingenieurhochschule Dresden (German Democratic Republic)). pp 711-712 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1464 **Wave structure of an electric discharge cathode zone in the helium flow.** Kiselevskii, L.I.; Klygin, N.Ya.; Soloviyanchik, D.A.; Feshchenko, Z.P. (AN Belorusskoj SSR, Minsk. Inst. Fiziki). pp 713-714 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1465 **Some peculiarities of a gas discharge in a gap with dielectric.** Sokolova, M.V. (Moskovskij Ehnergeticheskij Inst. (USSR)). pp 715-716 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1466 **Collision dominated electron distribution function with turbulent heating in the $H_2$ plasma.** Winkler, R.; Wilhelm, J. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik); Starykh, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). pp 739-740 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1467 **Transition to quasistationary electron energy distribution after application of electric field.** Naidis, G.V. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). pp 741-742 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1468 **Collision dominated final periodic state of the electron ensemble and its adjustment in a periodic electric field.** Winkler, R.; Wilhelm, J. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). pp 743-744 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1469 **Relation between mobility and diffusion in swarms.** Kumar, K. (Australian National Univ., Canberra. Dept. of Theoretical Physics). pp 747-748 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1470 **Non equilibrium dissociation rates of diatomic species. A comparison between numerical and analytical methods.** Capitelli, M. (Bari Univ. (Italy)); Dilonardo, M. (Consiglio Nazionale delle Ricerche, Bari (Italy). Centro di Studio per la Chimica dei Plasmi). pp 751-752 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1471 **Kinetic equation for electrons in metallic and gaseous plasma with account for exchange effect.** Klyuchnikov, N.I.; Trigger, S.A. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). pp 753-754 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1472 **Iterative method for computing velocity distribution functions of low-concentration particle components in a given non-uniform background.** Kuhn, S. (Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik). pp 755-756 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1473 **Computer simulation of ion trajectories.** Haeuser, J. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik); Tanzer, F. (Giessen Univ. (Germany, F.R.). 1. Physikalisches Inst.). pp 757-758 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1474 **Computer simulation of equilibrium and kinetic properties of ionic and plasma clusters.** Vorontsov-Veliaminov, P.N.; Shevkunov, S.V.; Fursey, G.N. (Leningradskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Fizicheskij Inst.). pp 759-760 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1475 **Nonstationary signal transition in linearized plasmas.** Turski, A.J. (Politechnika Swietokrzyska, Kielce (Poland)). pp 761-762 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1476 **Study of the dense weakly ionized mercury plasma by the method of molecular dynamics.** Lagar'kov, A.N.; Sarychev, A.K. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). pp 763-764 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1477 **Renormalization group method for the calculation of the conductivity of a dense weakly ionized plasma.** Sarychev, A.K. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). pp 765-766 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1478 **Experiment on development of high pressure laser plasma and absorption of laser.** Yamada, J. (Aichi Inst. of Tecchnology (Japan). Dept. of Electronics); Okuda, T.; Sakakibara, T. (Nagoya Inst. of Tech. (Japan)). pp 885-886 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1479 **Magnetic field effect upon maintenance of continuous optical discharge in gases.** Kurbatov, A.A.; Popova, T.Ya.; Preobrazhensky, N.G. (AN SSSR, Novosibirsk. Inst. Teoreticheskoj i Prikladnoj Mekhaniki). pp 899-900 of Proceedings of the 13th International Conference on Phenomena in Ionized Gases, Berlin, September 1977. Contributed papers II. Berlin, German Democratic Republic; Physical Society of the GDR (1977).

From XIII international conference on phenomena in ionized gases; Berlin, German Democratic Republic (Sep 1977).

1480 **Heat transfer by a developing magnetohydrodynamic flow with Hall and ion slip currents.** Mittal, M.L.; Bhat, A.N. (Indian Inst. of Tech., Bombay. Dept. of Mathematics). pp 247-253 of Proceedings of fourth national heat and mass transfer conference 1977 [held at Roorkee]. Meerut, India; Sarita Prakashan (1977).

From 4. national heat and mass transfer conference; Roorkee, India (21 Nov 1977).

The present investigation deals with the problem of steady state heat transfer in the flow entrance region of a parallel plate

channel. The effects of the Hall and the ion slip currents are included by using the generalized Ohm.s law. The magnetic Reynolds number is taken to be small. The governing equations are solved numerically. It is found that the Nusselt number decreases sharply in the developing flow region (as compared to fully developed flows).

## 6451 Particle Interactions And Properties - Experimental

*REFER ALSO TO CITATION(S) 1535, 1579, 1580, 1581, 1582, 1616*

1481 (JINR-D—2-11707, pp 435-463) **Analysis of elastic scattering in the method of the generalized matrix of reactions.** Edneral, V.F.; Troshin, S.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1979. (In Russian). Dep. NTIS (US Sales Only).

From 11. international school for young scientistis on high energy physics and relativistic nuclear physics; Gomel, Byelorussian SSR (12 Sep 1977).

The experimental data on elastic scattering of hign-energy hadrons were analyzed. The main attention was drawn to an analysis of the total cross sections and angular distributions in elastic scattering. The analysis was carried out in the framework of the generalized U matrix. The data on the total cross sections of pp, $K^+$, p and $\pi^+$ p-interactions and on differential cross section of elastic scattering of the corresponding processes were studied. The presence of a diffraction structure in the $\pi^+$ p-scattering was revealed and a logarithmic growth of the total cross section in the region of attainable energies was found. The experiments of elastic scattering were examined in the representation of the impact parameter. The behaviour of spectral densities of the contribution of elastic and inelastic channels to the unitarity relation was studied. The geometric similarity property in the method of the generalized matrix of reactions was considered. The hypothesis of the geometric similarity was shown to be of a restricted character and applicable in the IFVE, FNAL and ISR energy ranges for pp-interactions.

1482 (KFTI—80-6, pp 8-9) **Pion minus photoproduction on neutrons by polarized photons in the 0.9-1.65 GeV energy range.** Abramyan, L.O.; Avakyan, R.O.; Agan'yants, A.O. (AN Armyanskoj SSR, Erevan. Inst. Fiziki) (and others). 1980. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The asymmetry of the $\gamma n \rightarrow \pi^- p$ reaction cross section has been first measured in the 0.9-1.65 GeV photon energy range in the range of 30-60 deg angles of $\pi^-$-meson escape in the center-of-mass system. Polarized photons were obtained by means of coherent bremsstrahlung on a diamond crystal. A liquid-deuterium target was employed, $\pi^-$-mesons were detected by a magnetic spectrometer, recoil protons were detected in coincidences with $\pi^-$-mesons by means of a 12-module time-of-flight neutron spectrometer. The asymmetry values obtained are tabulated and are also plotted in graphs of angular and energy dependences. The results of measurements are compared with the available model predictions for the resonance region. A good agreement with theoretical data is observed.

1483 (TRI—79-1, pp 75-81) **Kaon elastic and inelastic scattering at 800 MeV/c.** Eisenstein, R.A. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

Data recently acquired at Brookhaven for K+- elastic and inelastic scattering from $^{12}C$ and $^{40}Ca$ targets are compared to calculations based on simple first-order theories of the scattering process.

1484 (TRI—79-1, pp 4-11) **Nuclear physics with kaons.** Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

The types of nuclear and elementary particle questions which can be addressed by studying kaon-induced reactions in nuclei are reviewed.

1485 (TRI—79-1, pp 101-104) **Measurement of $K^{+-}$-nucleus elastic scattering at forward angles. An experiment to be done at KEK.** Endo, I.; Sumi, Y. (Hiroshima Univ. (Japan). Dept. of Physics). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

A measurement of elastic $K^{+-}$-nucleus scattering is going to be made by Hiroshima University group at the low-energy separated beam site, K3, of KEK, Tsukuba, Japan. By detecting forward scattered kaons at lab angles less than 200 mr and lab momenta below 1 GeV/c, we will systematically study the energy dependence of forward differential cross sections $d\sigma/dt$, together with the ratio $\alpha$=Ref(0)/Imf(0) determined from the Coulomb interference for the forward elastic amplitude f(0) and $K^{+-}$-nuclear total cross sections $\sigma$(sub)T.

1486 (TRI—79-1, pp 105-108) **Production in anti p - d interactions below 1 GeV/c.** Smith, D.W.; Billiris, B.; Mandelkern, L.R.; Price, L.R.; Schultz, J. (California Univ., Irvine (USA)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

382 $\Lambda$ events have been measured and analyzed in an anti p - d bubble chamber experiment at 552, 740, and 905 MeV/c. We compare our data with two other anti p - d experiments at beam momenta from 1 to 3 GeV/c. Some features of the double scattering mechanism are calculated using an anti K and anti $\Lambda$ as the exchanged particles. The anti K exchange appears to be a more likely candidate for the production mechanism.

1487 **Precise measurement of the ratio of the axial vector coupling to vector coupling in $\Lambda^0 \rightarrow p + e^- +$ anti $\nu$.** Wise, J.; Jensen, D.A.; Kreisler, M.N.; Lomanno, F.; Poster, R.; Rabin, M.S.Z.; Raychaudhuri, K.; Way, M. (Massachusetts Univ., Amherst (USA). Dept. of Physics and Astronomy); Humphrey, J. (Brookhaven National Lab., Upton, NY (USA)). *Physics Letters,* [*Section*] *B;* **98**: No. 1/2, 123-126(1 Jan 1981).

The ratio of the axial vector coupling constant to the vector coupling constant, $/g_1(0)/f_1(0)/$, in the process $\Lambda^0 \rightarrow p + e^- + \nu$ has been measured in a high statistics study of the decay. The analysis of a sample of 10,000 events includes effects such as radiative corrections and $q^2$ dependence of the form factors. Our result is that $/g_1(0)/f_1(0)/ = 0.734 +- 0.031$. This value combined with our previous measurement of the ratio GAMMA($\Lambda^0 \rightarrow$ peanti $\nu$)/GAMMA($\Lambda^0 \rightarrow p\pi^-$) permits the calculation of $/f_1(0)/ = 1.229 +- 0.035$ and $/g_1(0)/ = 0.903 +- 0.046$ in remarkable agreement with the traditional models of the weak interaction.

1488 **Observation of a direct low-mass $e^+e^-$ continum in $\pi^-$p interactions at 16 GeV/c.** Stroynowski, R.; Dunwoodie, W.; Leith, D.W.G.; Fieguth, T.; Gilchriese, M. (Stanford Linear Accelerator Center, CA (USA)); Blockus, D.; Woody, C.L.; Barnett, B.; Chien, C.Y. (Johns Hopkins Univ., Baltimore, MD (USA)); Marshall, M. (California Inst. of Tech., Pasadena (USA)). *Physics Letters,* [*Section*] *B;* **97**: No. 2, 315-319(1 Dec 1980).

The production of prompt electron-positron pairs in 16 GeV/c $\pi^-$p collisions has been measured using the LASS spectrometer at SLAC. An excess of events is observed above the estimated contribution of direct and Dalitz decays of known resonances in the kinematic range defined by $0.1 <= chi <= 0.45$, $0 <= psub(T) <= 0.8$ GeV/c and $0.2 <= M(e^+e^-) <= 0.7$ GeV/$c^2$. The excess signal decreases slowly with increasing M, but exhibits very steep x and $p^2$sub(T) dependence.

1489 **Observation of the radiative transition PSI $\rightarrow \gamma$E(1420).** Scharre, D.L.; Thrilling, G.H.; Abrams, G.S.; Alam, M.S.; Blocker, C.A.; Blondel, A.; Boyarski, A.M.; Breidenbach, M.; Burke, D.L.; Carithers, W.C. (Stanford Linear Accelerator Center, CA (USA). *Physics Letters,* [*Section*] *B;* **97**: No. 2, 329-332(1 Dec 1980).

We have observed a radiative transition from the psi to a state decaying into Ksub(S)Ksup(+-)πsup(-+), with mass M = 1.44$^{+0}$sup(.)$^{01}$sub(-)$_{0}$sub(.)$_{015}$ GeV/c$^2$ and width GAMMA = 0.05$^{+0}$sup(.)$^{03}$sub(-)$_{0}$sub(.)$_{02}$ GeV/c$^2$. We tentatively identify this state as the E(1420). Assuming that this state is an isospin singlet, we have determined the branching fraction product B(psi → γE) x B(E x Kanti Kπ) = (3.6 +- 1.4) x $10^{-3}$.

**1490 Production of large Psub(T) single particles and multiparticle systems (jets) in K⁻p interactions at 110 GeV/c.** Bardadin-Otwinowska, M. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej). pp 251-260 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We present a brief summary of a study of single particles and multiparticle systems (jets) produced at large transverse moments in K⁻p collisions at 110 GeV/c. Results are compared with the data of a Fermilab experiment at 200 GeV, that have been interpreted as evidence for jet production.

**1491 Coherent (1), semicoherent (2) and incoherent (3) interactions on nuclei at 40 GeV/c.** Abrosimov, A.T. (Bologna Univ. (Italy). Ist. di Fisica); Albini, E. (Milan Univ. (Italy). Ist. di Fisica); Ananjeva, M.A. (Institute of Nuclear Research, Warsaw (Poland)) (and others). pp 175-195 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The coherent and incoherent production on different nuclei and semicoherent elastic scattering on carbon nucleus have been studied at the Serpukhov accelerator (40 GeV of incident energy). The more significant results pointed out can be summarized as follows: (i) The nuclear matter is transparent for fast secondaries. (ii) The Glauber theory reproduces quite well the differential cross sections both for elastic scatterings and coherent productions. (iii) The pseudorapidity distributions for secondary particles in incoherent interactions depend on the multiplicity, but are not affected by the nuclear target.

**1492 Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum.** Bialkowska, H. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej). pp 203-210 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

This is a very brief report on some of the results obtained at the JIMR Laboratory of High Energy in Dubna, in one of the experiments studying nucleus-nucleus collisions at relatively high energies. The detector consisted of a propane bubble chamber with thin metalic plates made of $^{181}$Ta mounted inside. At energy 4.2 GeV/c per nucleon there were four beams available: protons, deuterons, alpha particles and carbon ions $^{12}$C. The following results, based on the statistics of about 500 to 1500 interactions per beam and per target are already available: (1) The dependence of the dispersion of multiplicity of produced particles on the average sultiplicity. (2) The relation between the average number of interacting beam nucleons and the multiplicity of produced particles. (3) Emissions of fast protons.

**1493 Inclusive distributions in double scattering process in πpd interactions at 205 and 360 GeV/c.** Abramowicz, H. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej). pp 211-222 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We present results on double scattering inclusive production and compare our data with $\pi^-$p interactions at the same energy. We stress the similarity between the double scattering process and $\pi^-$p interactions.

**1494 Meson production in K⁻p interactions at 70 GeV/** C. Barloutaud, R. (Saclay-Rutheford-Paris Collaboration). pp 242-246 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The purpose of this communication is to present some results on pion and kaon production in K⁻p interactions at 70 GeV/c, to compare them with those at lower energy in K⁻p and more generally in hadron-hadron and ν interactions. The data come from an exposure of B.E.B.C. filled with hydrogen, to a 70 GeV/c K⁻ r.f. separated beam, in which about 50 000 pictures were taken. The primary events and their associated γ'/sub s/ and V⁰'s were doubly scanned and measured. The results presented here are based on a partial statistics of 3900 primary, 1600 γ and 400 K⁰/sub s/ events.

**1495 Observation of new lambda anti lambda states.** Baloshin, O.N.; Barkov, B.P.; Bolonkin, B.V. (Institute of Theoretical and Experimental Physics, Moscow, USSR) (and others). pp 365-379 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We have investigated lambda anti lambda system, produced in the πanti p interaction at incident pion momentum 40 GeV/c. The bump with M (lambda anti lambda) = 3430 MeV/c$^2$, Gamma<45 MeV/c$^2$, is observed in the mass spectrum of lambda anti lambda system. The angular distribution of lambda anti lambda in this region does not contradict J/sub PC/ = $2^{--}$. The spin state and spherical harmonic momenta analysis in mass range 2.23 +- 3.0 GeV/c$^2$ gives strong indications of the existence of two more states with the masses of 2510 +- 25 MeV/c$^2$, 2820 +- 40 MeV/c$^2$ and the widths of 124 +- 53 MeV/c$^2$, 132 +- 80 MeV/c. The preferred quantum numbers of these states (J/sup PC/) are $2^{++}$ and $4^{++}$, respectively.

**1496 Observation of an excess of events in e⁺e⁻ annihilations into neutral final-states leading to three electromagnetic showers at 10 GeV.** Bienlein, J.K.; Hoerber, E.; Leissner, M.; Niczyporuk, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)) (and others). pp 518-530 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

During the T investigation at DORIS, we observed six events in the $e^+e^-$ annihilation into three electromagnetic showers in a particular kinematical configuration where QED prediced 1.0 +- 0.4 events for the three-photon final-state. The excess events were not related to the T resonance. A cross-section of approximately 70 pb has been determined.

**1497 Production of lepton pairs at the ISR.** Belletini, G. (Istituto Nazionale di Fisica Nucleare, Pisa (Italy)). pp 539-571 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

Inclusive studies of lepton pair production in proton-proton collisions have lead to historical triumphs, the discovery of the J and particles at BNL and FNAL. These studies are also intensively pursued at the CERN ISR where √s can reach 62 GeV and $1^+1^-$ systems with M/sub $1^+1^-$/- > approximately 30 GeV can be readily produced in inelastic collisions. The energy should be enough to

produce the lowest t anti t state of the hypothetical top quark. Although this state has until now escaped detection, the ISR data are providing important information on (a) the energy dependence of the non-resonant lepton-pair cross-section (Drell-Yan scaling), (b) the energy dependence of the $\gamma$ excitation cross -section, and (c) the correlation between massive lepton pairs and the associated hadrons.

1498 **$\pi p \pi^-$ scattering at high energies.** Zieminski, A. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej). pp 587-600 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We present an attempt to extract information on $\pi^-\pi^-$ scattering from an analysis of the inclusive reaction $\pi^- n \rightarrow p + X^{--}$ for .05 <= /t/sub np// <= 1.0 GeV$^2$. The data come from three deuterium bubble chamber experiments at 21, 205 and 360 GeV/c and were analysed by Cambridge - Cracow - Warsaw and Cracow - Davis -Seattle - Warsaw Collaborations. The t/sub np/ cut corresponds to laboratory moments of protons smaller than 1.14 GeV/c, thus protons were identyfied by their ionization in the bubble chamber.

1499 **Evidence for scale breaking of the pion structure function.** McCal, D.; LeBritton, J.; Metcalf, W.; Melissions, A.C.; Alspector, J.; Borenstein, S.; Kalbfleisch, G.; Strand, R.C.; Abashian, A. (Rochester Univ., NY (USA). Dept. of Physics and Astronomy). pp 607-625 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We present data on dimuon production by $\pi^+$ and $\pi^-$ beams. From the data we establish the fraction of dimuons produced through q anti q annihilations and extract the structure function of the pion. By comparing our result with data obtained at 225 it is shown that the structure function depends on $M^2$, the mass squared of the dimuons. The $M^2$ dependence is in close agreement with the predictions of QCD.

## 6452 Particle Interactions And Properties - Theoretical

*REFER ALSO TO CITATION(S) 1483, 1531, 1537, 1540, 1541, 1546, 1567, 1625, 1626*

1500 (KFTI—80-6, pp 86-90) **Theory of electron-positron pair production at superhigh energy.** Boldyshev, V.F.; Peresun'ko, Yu.P. 1980. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

Photoproduction of wide-angle $e^+e^-$ pairs on nuclei is considered for the case of symmetric kinematics used in experiments on testing the quantum electrodynamics. The charge distribution in a nucleus is described by the Fermi two-parameter model. The obtained invariant mass distribution of produced pairs is found to have the typical diffraction structure with many minima. The accountancy of higher nucleus field corrections may shift minima positions.

1501 (TRI—79-1, pp 74) **Meson spectra.** Liu, K.F.; Wong, C.W. (California Univ., Los Angeles (USA)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

1502 (TRI—79-1, pp 82-91) **Kaon-nucleus interactions.** Takakin, F. (Pittsburgh Univ., PA (USA)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

The $K^-$-nucleon resonances are disucussed. Then $K^-$-nucleus optical potential parameters are deduced from the recent Alston-Garnjost et. al. $K^-$-N amplitudes by use of a simple, standard impulse approximation approach. The role of the resonances and of nucleon motion are investigated to see how the various $K^-$-N resonances affect the $K^-$-nucleus absorption and the associated cross-sections. The absorption induced by the basic $K^-$-N resonances is seen to be much larger than for the $K^+$ case, but not as large or dramatically energy-dependent as for pions. Nucleon motion is found to be very significant especially near the narrow resonances. Illustrative results are presented which demonstrate that close scrutiny, theoretically and experimentally, will be required to reliably extract information about $Y^*$-dynamics.

1503 (TRI—79-1, pp 92-96) **Neutron density studies through $K^+$-nucleus scattering.** Cotanch, S.R. (North Carolina State Univ., Raleigh (USA)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

The neutron nuclear structure (ground state) probing capability of the $K^+$ meson is examined theoretically through elastic scattering calculations for $^{40}$Ca and $^{48}$Ca. The study focuses on cross section sensitivity to existing uncertainties in the kaon-nucleon (KN) interaction and target neutron distribution. The sensitivity to these two uncertainties is assessed by performing calculations using Martin vs. BGRT KN phase shifts and Hartree-Fock vs. empirical neutron densities. Results predict sizeable (100 percent) changes in the absolute elastic cross section that is predominantly attributable to the uncertainties in the KN interaction. However, for the relative cross section difference between isotopes variations in the neutron density and the KN interaction produce roughly equal effects.

1504 (TRI—79-1, pp 97-100) **Kaon-nucleus interactions in the $\Lambda$(1520) region.** Epstein, G.N.; Moniz, E.J. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Theoretical Physics). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

Kaon-nucleus interactions in the energy region dominated by $\Lambda(1520, 3/2^-)$ formation are very interesting for the study of isobar propagation in the nuclear medium. In this paper we present some simple calculations aimed at extracting some of the features of the physics in this regime.

1505 (TRI—79-1, pp 160-163) **Atomic bound states of the proton anti proton system.** Kaufman, W.B. (Arizona State Univ., Tempe (USA)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

The purpose of this calculation is to compute the strong interaction level widths and shifts for the Coulomb bound states of a proton and an antiproton. The real part of the hadronic potential is described by a meson-exchange potential and the annihilation by an incoming wave boundary condition. The incoming or black sphere condition is expected to given an approximate upper limit on the level widths consistent with smoothly varying potentials.

1506 **Bosons and groups in nuclear physics.** Morrison, I. (Australian National Univ., Canberra. Research School of Physical Sciences). pp E2 of A.I.P. 4th national congress, Melbourne 1980. Melbourne, Australia; Australian Institute of Physics (1980).

From 4. National congress of the Australian Institute of Physics; Melbourne, Australia (25 Aug 1980).

1507 **Phenomenological model for Cabibbo favoured charmed meson decays into three pseudoscalars: Psub(c) → PPP.** Miller, R.D.C.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). pp EP1 of A.I.P. 4th national congress, Melbourne 1980. Melbourne, Australia; Australian Institute of Physics (1980).

From 4. National congress of the Australian Institute of Physics; Melbourne, Australia (25 Aug 1980).

1508 **Electromagnetic decay widths for L=1 Jsup(PC) = $1^{--}$ T-baryonia.** Ellis, R.G.; McKellar, B.H.J.; Joshi, G.C. (Melbourne Univ., Parkville (Australia). School of Physics); Anderson, R. (Oxford Univ. (UK). Dept. of Theoretical Physics). pp EP4 of A.I.P. 4th national congress, Melbourne 1980. Melbourne, Australia; Australian Institute of Physics (1980).

From 4. National congress of the Australian Institute of Physics; Melbourne, Australia (25 Aug 1980).

1509 **Oscillations of massless neutrinos as a refractive phenomenon.** Opat, G.I. (Melbourne Univ., Parkville (Australia). School of Physics). pp EP6 of A.I.P. 4th national congress, Melbourne 1980. Melbourne, Australia; Australian Institute of Physics (1980).

From 4. National congress of the Australian Institute of Physics; Melbourne, Australia (25 Aug 1980).

1510 **Structure of multiparticles in quark jets.** Chang, C.; Lo, S. (Academia Sinica, Beijing (China). Inst. of High Energy Physics). pp EP10 of A.I.P. 4th national congress, Melbourne 1980. Melbourne, Australia; Australian Institute of Physics (1980).

From 4. National congress of the Australian Institute of Physics; Melbourne, Australia (25 Aug 1980).

1511 **Angular flow of charge and energy in hadron hadron collisions.** Ochs, W.; Shimada, T. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). pp 41-47 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We discuss how measurements of the angular flow of charge and energy can distinguish between different parton models for hadron hadron collisions.

1512 **Inclusive $\pi i/\pi^-$ ratio in meson-proton reactions and the quark recombination model.** Buschbeck, B.; Gerhold, H.R. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik); Kittel, W. (Katholieke Univ. Nijmegen (Netherlands)). pp 49-58 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The inclusive $\pi^+/\pi^-$-ratio in $\pi^{+-}$p and $K^{+-}$p reactions at different incident energies has been compared to that of pp reactions. Up to 100 GeV/c a significant dependence on the beam quantum numbers has been observed for this ratio in the target fragmentation region. Since the quark recombination model cannot account for this effect, an additional mechanism is considered in a triple Regge and, alternatively, in a quark annihilation description.

1513 **Particle production from nuclear targets.** Busza, W. (Institute of Nuclear Research, Warsaw (Poland)). pp 145-173 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The kind of information about hadrons that can be or has been extracted from nuclear data is under discussion. Some less known facts and most recent results are reviewed.

1514 **Drell-Yan process as a test of models for particle production on nuclei.** Jaroszewicz, T.; Jezabek, M. (Institute of Nuclear Physics, Krakow (Poland)). pp 203-210 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

In this note we discuss two models, which can be termed sequential and parallel multiple scattering models. We show that, although both models describe equally well the distribution of the produced hadrons, it is possible to discriminate between them by looking at the inclusive production of massive lepton pairs (assumed to go via Drell-Yan (D-Y) mechanism).

1515 **Particle production in anti pp annihilation and non-annihilation.** Markytan, M. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). pp 223-240 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

After an introduction into the general characteristics of anti pp annihilation, the energy dependence of this reaction mechanism is discussed on the basis of the hypothesis that one valence quark - antiquark pair is kinematically in a wee state and annihilated. The experimental x distributions of inclusive $\pi^+$-,rho$^0$ and f production from anti pp annihilation are found to show a (1 - x)/sup n/ dependence with a lower exponent than the corresponding anti pp non-annihilation or pp inclusive reactions. This behaviour is discussed by means of the triple Regge pole model and a diquark cluster model with recombination.

1516 **Naive model of hadrons and hadronic processes.** Predazzi, E. (Turin Univ. (Italy). Ist. di Fisica). pp 247-249 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We aim to show that an extremely simple minded model of hadronic processes starting from hadrons as composite objects, properly implemented by Heisenberg-like relations suggested by high energy data can account for a number of well-known properties of high energy hadronic reactions.

1517 **Colour isomers in multiquark systems.** Hoegaasen, H. (Oslo Univ. (Norway)). pp 294-305 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

If we select configurations where a high angular momentum separates coloured groups of quarks the states can be sufficiently stable to show up as resonances. The kind of states I shall talk about are mesons of the following kind (C=6,7), (C=3 bar,3) and baryons: (C=8,8), (C=6 bar,6). In each state the quarks on each end of the colourelectric flux tube are taken to be in relative s-waves. Models for baryonium and of narrow mesobaryonium states have been proposed on the basis of these configurations. The theoretical input in these models is an extrapolation of what is known about quark-quark interactions from ordinary q anti q and qqq spectroscopy.

1518 **Structure of baryonium and its manifestation in multiparticle production processes.** Shapiro, I.S. (Institute for Theoretical and Experimental Physics, Moscow, Union of Soviet Socialist Republics). pp 307-317 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The effect of the baryonium on branching ratios and energy behaviour of the multiparticle production cross sections in the processes hadron - hadron and $e^+e^- \rightarrow$ hadrons is discussed.

1519 **D-meson inclusive production in $e^+e^-$ annihilation.** Kartvelishvili, V.G.; Lichoded, A.K.; Slabospitsky, S.R. (Institute for High Energy Physics, Serpukhov, Union of Soviet Socialist Republics). pp 319-327 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The c-quark fragmentation function in D-meson, calculated previously is shown to be in a good agreement with new experiments.

1520 **Production of D- and PSI-mesons in hadron interactions.** Kartvelishvili, V.G.; Lichoded, A.K.; Slabospitsky, S.R. (Institute for High Energy Physics, Serpukhov, Union of Soviet Socialist Republics). pp 328-341 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

Some aspects of D- and PSI-meson production in hadron interactions are discussed. The cross sections are calculated and the results of the theoretical investigations are compared with the experiment.

1521 **Why rising cross-sections are further evidence for a non-Abelian gauge theory of strong interactions.** White, A.R. (European Organization for Nuclear Research, Geneva (Switzerland)). pp 381-403 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

An outline is given of a complete argument that local non-Abelian gauge invariance implies the critical Pomeron, and hence rising total cross-sections, at high energy. The derivation of the Reggeon unitarity equations from multiparticle dispersion relations is briefly described, followed by the path integral solution of these equations for the case of the Pomeron. When the Pomeron intercept is formally above one there is spontaneous generation of degenerate odd-signature trajectories giving massive vector particles. The general formalism is then applied to develop the leading log calculations of spontaneously broken Yang-Mills into a full Reggeon field theory of odd signature Reggeons. The high energy phase in which the Pomeron intercept is formally above one is realized in SU(N) Yang-Mills theory when the gauge symmetry is broken down to a (confined) U(1) symmetry. The intercept one critical Pomeron is then seen to occur when the non-Abelian gauge invariance is restored.

1522 **Production of real photons, leptons and hadrons in hadron-hadron collisions.** Krawczyk, M. (Warsaw Univ. (Poland). Inst. Fizyki Teoretycznej); Ochs, W. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). pp 503-509 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We find a certain regime of phase space close to the edge where the direct production of single particles or particle pairs in a hard collision of partons dominates the indirect one which proceeds through a sequence of steps. In this kinematic regime a new type of parton process q anti q $\rightarrow \gamma\gamma$ may become accessible experimentally. This region is also recommended for further search of heavy resonances. A striking effect is predicted there for the hadrons (leptons and hadrons) photons production ratios which should drop to zero, if hadrons are produced indirectly through parton decays. The study of pair production is expected to lead to more stringent conclusions on the underlying dynamics than the study of single particle production.

1523 **Jet production in $e^+e^-$ collisions to order $\alpha^3$ and $\alpha^4$ and including QCD.** Raitio, R. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). pp 511-516 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

Cross sections for $e^+e^- \rightarrow jet_1 + jet_2 + X$ are calculated to order $\alpha^3$ and $\alpha^4$ in the electromagnetic coupling and to arbitrary order in $\alpha$/sub s/ in the leading logarithm approximation of QCD. Physically the processes included are emission of hard photons from the incident $e^{+-}$ followed by annihilation, photon-photon scattering and deep inelastic scattering on an electron.

1524 **Pion form factor as a Pade type approximation in the conformally mapped variable.** Dubnicka, S. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). pp 602-606 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

In this contribution we shall show, that the conformal mapping is a very powerful tool in the construction of the pion form factor from the analyticity, which describes all the data and contains only physically interpretable parameters. Moreover, it enables us to test the asymptotic behaviour the pion electromagnetic formactor.

1525 (IPNO-TH—80-49, pp 1-8) **M.I.T. bag model, mass differences, and $q^3\,q^{-3}$ states of hidden colour.** Buck, W.W. [nd]. Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

The M.I.T. bag model of hadrons is reviewed and is applied in the determination of the K→antiK, D→antiD and B→antiB transition amplitudes needed in the evaluations of mass differences. Also application is made to multiquark states of $q^3\,q^{-3}$ out of which emerge states of 'hidden colour'.

1526 (IPNO-TH—80-49, pp 1-4) **Attempt to derive the hadron mass spectrum from the topological expansion.** Nicolescu, B. [nd]. Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

Semi-local duality is imposed on an infinite sum of ladder graphs in the framework of DTU. This leads to a generic Regge-trajectory formula which when applied to entire sets of processes, gave powerful self-consistency conditions. We are then able to calculate the masses of ordinary and multiquark hadrons. The only arbitrary parameter is the mass of the rho, which merely serves to set the mass scale. We are also explaining why narrow multiquark hadrons are rare events, strongly coupled only to some particular channels and appearing only in some restricted mass regions. One of the predictions of our approach is the existence of several baryonium states below the N-antiN threshold.

1527 (IPNO-TH—80-49, pp 1-4) **Leptons, quarks and hadrons in a same theoretical approach.** Elbaz, E. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). [nd]. (In French). Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

1528 (IPNO-TH—80-49, pp 1-13) **Paris potential and recent observables.** Lacombe, M. [nd]. (In French). Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

We compare recent data on p-p and p-n scattering at low and medium energy to the values produced by the Paris N-N potential, the agreement is very satisfactory.

1529 (IPNO-TH—80-49, pp 1-15) **Joining the quark theory to the hadron exchange theory of interactions.** Lomon, E. [nd]. Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

The quantum relativistic field theory of hadron exchange has provided an excellent description of medium and long range forces ($r > 1/2\mu^{-1}$) for low energy nucleon-nucleon interactions (E/sub L/ <350MeV). We demonstrate that the successful application of this approach can be extended to medium energies (350MeV < E/sub L/ < 1000MeV) after including the effect of the coupling of the nucleon-nucleon to nucleon-isobar channels.

1530 (IPNO-TH—80-49, pp 1-67) **Λ and Σ hyperons in nuclei.** Bouyssy, A. [nd]. (In French). Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

Two-body strangeness exchange reactions with kaon beams are the modern way to produce and study hypernuclei. Recent experimental data are analyzed with a simple model in the framework of the impulse approximation. Precise determinations of the characteristics of the Λ-nucleus interaction can then be deduced. The comparison with the nucleon-nucleus interaction allows on interpretation of the origin of the spin-orbit force. Preliminary results on light Σ-hypernuclei are a step towards a better understanding of the baryon-baryon interaction.

## 6454 Field Theory

*REFER ALSO TO CITATION(S) 1523*

1531 (TRI—79-1, pp 33-42) **Hyperon physics and chromodynamics.** Isgur, N. (Toronto Univ., Ontario (Canada). Dept. of Physics). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

After briefly reviewing QCD and introducing the elements of QCD-based models of hadronic structure, the relevance of hyperon resonance physics to testing such models is discussed.

1532 **Baecklund transformation, local and nonlocal conservation laws for super-chiral fields.** Popowicz, Z. (State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics); Chau Wang, L.L. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.). *Physics Letters,* [*Section*] *B;* **98**: No. 4, 253-256(15 Jan 1981).

New non-local conservation laws, parametric Baecklund transformation and local conservation laws are constructed for super-chiral fields in general, using similar methods for ordinary chiral fields. We thus have a unified view of these field theories.

1533 **CPsup(N-1) model with unconstrained variables.** Haber, H.E.; Hinchliffe, I.; Rabinovici, E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics* [*Section*] *B;* **172**: No. 2/3, 458-474(Sep 1980).

The CPsup(N-1) model is investigated in terms of unconstrained variables in both the lagrangian and hamiltonian formulations. The presence of a gauge ambiguity is intimately related with confinement and the appearance of a dynamically generated vector field. Various aspects of the spectrum of states in the large-N limit are investigated.

1534 **Quarks and hadrons: structure functions and fragmentation functions.** Dias de Deus, J. (European Organization for Nuclear Research, Geneva (Switzerland)). pp 31-40 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We discuss the use of quark model and/or phase space arguments to make guesses on structure and fragmentation functions at the hadronization starting point of QCD evolution.

1535 **QCD-tests in lepton nucleon scattering experiments.** Holder, M. (Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Experimentalphysik). pp 69-92 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

Recent experiments on nucleon structure functions are compared to QCD predictions with an emphasis on the experimental situation.

1536 **High order contributions to scaling violations in QCD.** Moshe, M. (Tel Aviv Univ. (Israel). Dept. of Physics). pp 94-97 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The exact evaluation of high order terms in the scaling violation pattern in QCD amounts to calculating the high order loops contributions to the renormalization group functions $\beta,\gamma$ and the coefficient C/sub i//sup n/. This is an extraordinary task already at the two loop level. It is shown here that a reasonable estimate of the next order term of O $((\log q^2)^{-}\gamma^{-2})$ can be obtained from the available two loop results by observing the special leading log structure of the renormalization group solution.

1537 **Gluon jet effects in deep inelastic lepton-hadron collisions.** Ranft, J. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). pp 99-102 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The emission of gluon jets in deep inelastic lepton-hadron collisions is predicted by QCD perturbation theory. We discuss observable effects in cross sections $d\sigma/dT$ and $d\sigma/dS$ in terms of the collective jet variables thrust and sphericity as well as in transverse momentum distributions.

1538 **Discussion of the CDHS charged current results.** Savoy-Navarro, A. (European Organization for Nuclear Research, Geneva (Switzerland)). pp 103-121 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

I will describe in Section 1 of this talk how we extract the structure functions from the experimental data, what we have to take into account and to correct for. A special emphasis will be put on a completely new way of computing radiative corrections in high energy deep inelastic processes. In Section 2 the present limitations of our study of charged currents will be discussed (especially concerning the Callen-Gross rule, the sea study, some tests of QCD, ...) and I will explain how we plan to solve these problems in the future.

1539 **Energy flow and energy-energy pattern in deep inelastic scattering.** Rueckl, R. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). pp 123-128 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

Perturbative QCD gives infrared finite predictions for the energy flow and the energy-energy pattern in deep inelastic scattering. I shall present some typical results and discuss their suitability for tests of perturbative QCD.

1540 **Constraint of color separation on perturbative QCD.** Chiu, C.B. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). pp 130-143 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

In the context of the space-time development of a QCD jet, we conjecture that there might be some constraints imposed on the jet development due to the color separation. Kinematic domain in $e^+e^-$-collision where such constraint could occur is discussed.

1541 **Theory of QCD plasma and hadronic collisions.** Shuryak, E.V. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). pp 262-267 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

Due to the recent progress in strong interaction theory based on QCD we know now, that the very dense or highly excited matter is not made of separate hadrons, but of unbound quarks and gluons in plasma like phase. In the present talk I would like to discuss some topics, connected with hadronic collisions, in which such phase of matter is produced. The macroscopic approach in form of thermo-and hydrodynamical models is known for long time, but only now we may say something about their validity limits.

1542 **Symmetric hadron pairs at large transverse moments as a test of the QCD model.** Baier, R.; Engels, J.; Petersson, B. (Bielefeld Univ. (Germany, F.R.). Abt. Theoretische Physik). pp 274-281 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

In a recent paper we investigated the inclusive production of hadron pairs with large transverse momenta (p/sub T/>or approximately 2 GeV/c) in opposite hemispheres, essentially back-to-back in the centre of mass system of the incoming hadrons. The purpose of this talk is to present the predictions of the quantum chromodynamic model (QCD) for the back-to-back cross section and the comparison with recent data of the Columbia-Fermi Lab-Stony Brook Collaboration.

1543 **Potential models of new particles.** Martin, A. (European Organization for Nuclear Research, Geneva (Switzerland)). pp 283-290 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The $\gamma$ state has been discovered by Lederman and later on produced in $e^+e^-$ collisions with at least 2 and very likely 3 levels. It is very tempting to consider this system as a non-relativistic Q anti Q system. Following the inspiration of QCD, one can try to fit the spectrum of the $\gamma$ with the same potential as for the J/PSI family. It has been done and it works, especially when the short distance attraction is softened to take into account asymptotic freedom. Under these circumstances it is of interest to try to see to what extent these results are dependent on the potential and what are the important and unimportant features of these potentials.

1544 **Relativistic potential model of charmonium.** Otwinowski, Z. (Polska Akademia Nauk, Warsay, Centrum Astronomiczne). pp 359-363 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsay University, Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

Charmonium potential models have been studied recently using Schroedinger equation with various qq static potentials. Kinetic energies obtained in these models were high enough for relativistic effects to be important. To account for some of these effects we use the Breit equation, written in the centre of mass coordinates. A simple form of potential $V(r) = -a/r+kr$ is used.

1545 **Colour singlets in perturbative QCD.** Bassetto, A. (Istituto Nazionale di Fisica Nucleare, Padua (Italy)). pp 405-411 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

In the axial gauge and at the leading log level, a definite and consistent picture seems to emerge of a parton decay into states in which many partons are found just before confinement should take place. They are grouped into colourless clusters in a number sufficient to exhaust the "final" state, still possessing a finite average mass. This result is peculiar of QCD, in particular of its non-abelian nature. Large transverse momenta or more generally average invariant quantities of partons are mainly due to the multiplicities involved in the branching processes. If eventually confinement would convert these clusters into hadrons (and this is of course the main issue which has still to be proven) without a large rearrangement of the colour lines, the picture we have found for colour singlets could apply to the real hadronic world.

1546 **Tests of QCD in two-photon collisions.** Frazer, W.R. (California Univ., San Diego, La Jolla (USA). Dept. of Physics). pp 439-456 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

The talk is devoted to the inclusive process $\gamma$/sup */(q) + $\gamma$/sup */(p) $\rightarrow$ hadrons. The totally inclusive process is found to be an extremely clean test of QCD. It is free from any assumptions about the details of the way quarks became hadrons; only a completeness assumption is required. The subject of jets is also touched and some of the jet predictions are discussed.

1547 **QCD tests: 3G vertex effects.** Furmanski, W. (Uniwersytet Jagiellonski, Krakow (Poland). Inst. Fizyki); Pokorski, S. (Warsaw Univ. (Poland). Inst. Fizyki Teoretycznej). pp 458-501 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

A direct experimental verification of the existence of the 3G vertex is necessary for an unambiguous QCD test. The 3G vertex reveals itself in the leading effects in the gluon jet fragmentation and in the higher order effects in lepton induced reactions. We discuss in detail: (a) a new method for the gluon jet and quark jet calorimeter study in large p/sub T/ hadron-hadron collisions, (b) the low (Bjorken) x region of deep inelastic structure functions, (c) the rise of heavy flavour multiplicity in $e^+e^-$ annihilation. For jet calorimetry, special attention is paid to get clean tests of perturbative QCD in spite of the contamination of non-perturbative effects. We conclude that the 3G vertex effects should be clearly seen with the forthcoming generation of accelerators. In the first of the paper the probabilistic parton model approach (which is used in the above applications) is reviewed. In particular the recently obtained exact solution of the $Q^2$ evolution equations is given.

1548 **Confrontation of geometrodynamics with experiment.** Csikor, F. (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary)). pp 573-577 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

A full list of unambiguous results of the geometrodynamical approach is given and compared with experiment.

1549 **Colour confinement effects in the presence of nuclear matter.** Rek, Z.J. (Warsaw Univ. (Poland). Wydzial Fizyki); Wilk, G. (Institute of Nuclear Research, Warsaw (Poland)). pp 579-585 of Proceedings of the 2. International symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

A simpleminded picture of the low p/sub T/ inclusive production on nuclei is given. The novel point is the conjecture, already investigated in the low p/sub T/ hadron-nucleon inclusive reactions, attributing the rising of hadron multiplicity to the necessity of the confinement of colour, the important subhadronic degree of freedom in the quantum chromodynamics. The elementary process is then viewed as proceeding in two stages: (a) The colour excitation of both incoming hadron, h → h/sub c/ and target nucleon, N → N/sub c/. (b) The so called colour compensating flow. This is the abbreviation of a very complicated phenomenon caused by the necessity of the confinement of colour entering dramatically when both h/sub c/ and N/sub c/ are receding from each other.

1550 (IPNO-TH—80-49, pp Pt.1 p.1) **Unified gauge theories and the problem of mass.** Kang, K. [nd]. Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

1551 (IPNO-TH—80-49, pp 1-2) **Bound states of heavy quarks.** Richard, J.M. [nd]. (In French). Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

A review of the phenomenology of quarkonium is presented. The QCD motivated bag model is described and applied to the αantiα, QantiQ-glue and QQQ heavy systems.

1552 (IPNO-TH—80-49, pp 1-31) **Constraints on nucleon quark models from deep inelastic scattering data.** Nataf, R. [nd]. Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

Within the context of Q.C.D. it is assumed that quarks and gluons have rather sharply defined masses in the confinement region. Then, the experimental data on structure functions give an upper limit to the light quark masses approximately equal to 100 MeV. Target mass corrections to scaling depend on further approximations.

### 6455 Scattering Theory

1553 (INIS-mf—6479, pp vp) **Exact solution of the inverse scattering problem at fixed energy.** Blazek, M. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). 1978. (In Slovak). Dep. NTIS (US Sales Only).

From 5. conference of Czechoslovak physicists; Kosice, Czechoslovakia (29 Aug 1977).

1554 **Jet properties and the parton interpretation of the leading log scheme.** Kirschner, R. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). pp 269-272 of Proceedings of the 2. international symposium on hadron structure and multiparticle production. Ajduk, Z. (ed.). Warsaw, Poland; Warsaw Univ., Inst. of Nuclear Research (1979).

From 2. international symposium on hadron structure and multiparticle production; Kazimierz, Poland (20 May 1979).

We are going to discuss some problems related to the study of the hadron jet structure in perturbative QCD. Lipatov derived an equation for the $q^2$-dependence of the structure function D/sub i//sup j/$(x,q^2)$ of a dressed quark or gluon i, which turns out to be equivalent to the Altarelli-Parisi equation. Lipatov's starting point was the observation that the set of leading log graphs contributing to D/sub i//sup j/$(x,q^2)$ can be interpreted in appropriate gauge in terms of a parton model with a large transverse momentum cut-off $\Lambda = (q^2)$. This method consists in studying the cut-off dependence of the quantities of interest.

## 65 PHYSICS RESEARCH

### 6510 Nuclear Physics

1555 (INIS-mf—6479, pp vp) **Computer code for nuclear decay scheme construction.** Hlavaty, L. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1978. (In Czech). Dep. NTIS (US Sales Only).

From 5. conference of Czechoslovak physicists; Kosice, Czechoslovakia (29 Aug 1977).

1556 (JINR-D—4-80-385, pp 89-141) **Electric and magnetic giant resonances of low multipolarity studied with inelastic electron scattering.** Richer, A. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). 1980. Dep. NTIS (US Sales Only).

From International school on nuclear structure; Alushta, USSR (14 Apr 1980).

The introduction into the field of electric and magnetic giant resonances in light and heavy nuclei is given. The recent experimental results on inelastic electron scattering obtained at the Darmstadt electron linear accelerator are used in the paper. The problem of extraction of information on electroexcitation of nuclei at low momentum transfer from the point of view of a test for nuclear models is briefly discussed. The main attention is paid to electric (E1 and E2) transitions in $^{11}$B, $^{28}$Si, $^{208}$Pb isotopes and to magnetic (M1 and M2) transitions in $^{12}$C, $^{16}$O, $^{28}$Si, sup(40, 42, 44, 48)Ca, $^{58}$Ni, $^{90}$Zr, $^{140}$Ce and $^{208}$Pb isotopes. Electric transitions are shown to have a collective nature while magnetic transitions don't show ony collectivity. The most interesting resUlt is the strong retardation of the M1 and M2 transition strengths in heavy nuclei as compared to the theoretical predictions.

1557 (ZfK—410, pp 130-139) **Nuclear data needs and related activities of the IAEA nuclear data section.** Schmidt, J.J. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Jan 1980. Dep. NTIS (US Sales Only).

From 9. international symposium on the interaction of fast neutrons with nuclei; Gaussig, German Democratic Republic (26 Nov 1979).

An overview is given of a part of the requests contained in the most recent edition of the World Request List for Nuclear Data (WRENDA 79/80) for charged particle, γ-ray and neutron nuclear data needed in selected areas such as the nuclear fission fuel cycle, nuclear fusion, nuclear materials safeguards, radiation damage and radiotherapy. Some of the activities of the IAEA Nuclear Data Section related to these requirements are briefly discussed.

### 6512 Nuclear Properties And Reactions, A=1-5

1558 (KFTI—79-48, pp 66-69) **Polarization effects in the γd→np reaction and D* resonances.** Kulish, Yu.V. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

Polarization phenomena in the γd→np reaction caused by polarization of two particles: γ, p; γ,d or d,p, are considered. In this case there are 34 observables determined in terms of spiral amplitudes. The observables are estimated in the model with dibarion resonance D*(Jsup(p)=2sup(+), I=1). The constants of the γdD* interaction are connected with the deuteron magnetic moment by means of the SU(4)sub(W) symmetry.

1559 (KFTI—79-48, pp 51-52) **Nucleon-nucleon potentials and quasi-free scattering of electrons by deuterons.** Ganenko, V.B.; Korchin, A.Yu.; Shebeko, A.V. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

Cross sections of the d(e,e) reaction near the threshold are calculated for the momentum transfers $q^2 <$ or approximately 6 $F^{-2}$. Sensitivity of cross sections to the choice of the nucleon-nucleon interaction model is studied. This interaction is described by the Yamachuga and Mongan potentials, by the Reid potentials with a soft core and by the Turei-Sprang potentials with a supersoft core. The calculated cross sections have been compared with the results of new precision experiments. It is shown that the experimental data can be adequately described by a conventional theory without using the exchange meson currents and isobar configurations in a deuteron.

1560 (KFTI—79-48, pp 49-50) **Electron quasi-free scattering by atomic nuclei in the interaction time approximation.** Korchin, A.Yu.; Shebeko, A.V. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The electron quasi-elastic scattering by atomic nuclei is studied with account of interaction of a knocked-out nucleon with a residual nucleus in the final state. Besides possibilities of the approach based on the interaction time approximation are considered for a description of the (e,e) reaction in the region of the quasi-elastic peak. The parameters defining the position of maximum, the height and the shape of quasi-elastic peak are found. The calculations of these values, carried out with due regard for exchange and nonlocal character of nuclear forces, show that along with the exchange part of the NN interaction, its nonlocality may produce a considerable contribution.

1561 (KFTI—79-48, pp 47-48) **Theory of electroproduction of small relative momentum nucleon pairs on atomic nuclei.** Nagornyi, S.I.; Inopin, E.V. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

Problems concerning knocking-out of nucleon pairs from atomic nuclei by high-energy electrons are studied. Dependences of cross sections of different processes of the knocking-out on the nucleon relative momentum in a pair are considered. Probabilities of different processes of the knocking-out are compared. A comparison of probabilities of total and three-particle splittings of a $^4$He nucleus is performed. On total splitting in the formation of the cross section energy dependence the levels of observable and non-observable subsystems shown to take place. It has been stated that the cross section cannot be increased at the expense of levels of both subsystems simultaneously.

1562 (KFTI—79-48, pp 36-37) **Role of meson currents in the complete photodisintegration of $^4$He nucleus.** Dzhibuti, R.I.; Kezerashvili, R.Ya.; Krupennikova, N.B. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The role of meson exchange currents in complete photodisintegration of a $^4$He nucleus has been investigated. The wave functions of the initial and final states of a four-particle system are obtained by applying the method of expansion in hyperspherical functions and using the Gogni-Peierls-de-Turreil potential. The same potential is used for finding an additional term in the hamiltonian of interaction of $\gamma$-quantum with a nucleus, the term being connected with meson currents. The meson currents have been shown to play an essential role at Esub($\gamma$)>80 MeV and their role is increased with account of the interaction in the final state.

1563 (KFTI—79-48, pp 38-42) **Complete photodisintegration of three- and four-particle nuclei.** Dzhibuti, R.I.; Kezerashvili, R.Ya. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The results of experimental and theoretical papers devoted to studying the processes of complete photodisintegration of three- and four-particle nuclei have been reviewed. The results of calculations of these processes based on using the variational method and also the Faddeev integral equation methods and expansion in the basis of hyperspherical functions are analyzed. The criticality of the results obtained by these methods to the type of nucleon-nucleon interaction is demonstrated the effects of interactions between all the nucleons in the final state being taken into account.

1564 (KFTI—79-48, pp 62-65) **Mechanism of three-particle photodisintegration of $^4$He.** Arkatov, Yu.M.; Vatset, P.I.; Voloshchuk, V.I.; Gur'ev, V.N.; Zolenko, V.A.; Prokhorets, I.M. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The $^4$He($\gamma$,pn)$^2$H reaction and contribution produced by a certain mechanism of the reaction are studied. The programs for identifying the polar mechanism and the mechanism of triangular diagram have been formulated. Experimental data are presented on kinetic energies of deuterons, protons and neutrons for the photon energy ranges of 28-45, 45-80 and 80-150 MeV and on relative energies of (pn),(pd) and (nd) pairs in the same energy ranges. Expressions are given for the phase volume and for calculation in polar approximation. Experimental and theoretical distributions are compared. A conclusion is made in favour of the polar mechanism of the $^4$He($\gamma$,pn)$^2$H reaction.

1565 (KFTI—79-48, pp 87-88) **Exchange internucleon interactions in deep inelastic electron scattering by nuclei.** Dementii, S.V.; Ogurtsov, V.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The electron inelastic scattering by $^4$He, $^9$Be, $^{12}$C, $^{16}$O nuclei has been studied for determining the role of exchange internucleon interactions. The experimental values of the energy-weighted Drell and Shwarz sum rules show that the electron mean energy loss at 3-momentum transfers of 240-420 MeV/c is increased due to exchange interactions by 35-55 %. The observed shift of the quasi-elastic peak maximum relative to the elastic ep scattering peak for $^9$Be, $^{12}$C, $^{16}$O nuclei also indicates that the role of exchange interactions is essential.

1566 (KFTI—79-48, pp 84-86) **Experimental study on the (e,e'p) reactions with helium isotopes.** Gol'dshtein, V.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The results of studying the (e,e'p) reaction on $^3$He and $^4$He isotopes under different kinematic conditions have been reviewed. The results obtained are compared with the calculations performed with account of interaction in the final state and of short-range correlations. It has been shown that in the measured range of recoil nucleus momenta in the case of $^4$He(e,e'p) the calculation well describes the experimental data. In the case of the (e,e'p) reaction the description of the total cross section by calculations using the Gauss wave function turned out to be inadequate, and the cross section of two-particle disintegration is well described by exact calculations on the base of the Reid potential with a soft core.

1567 **Meson exchange and the photodisintegration of the deuteron.** Woolcock, W.S. (Australian National Univ., Canberra. Research School of Physical Sciences). pp E4 of A.I.P. 4th national congress, Melbourne 1980. Melbourne, Australia; Australian Institute of Physics (1980).

From 4. National congress of the Australian Institute of Physics; Melbourne, Australia (25 Aug 1980).

1568 **Particle interactions with nuclei in the energy range of 0.1-5 TeV.** Kotlyarevskii, D.M. pp 42-71 of Protsess mnozhestvennoj generatsii pri vysokikh ehnergiyakh. Tbilisi, USSR; Metsniereba (1979). (In Russian)

To compile the data on the interaction of particles with nuclei, suggested is a review on the neutron interaction with the nuclei of $^1$H, $^2$D, $^9$Be, $^{12}$C, $^{27}$Al, $^{56}$Fe, $^{63}$Cu, $^{106}$Cd, $^{184}$W, $^{206}$Pb, $^{238}$U as well as p, p tidle, $\pi^{+-}$, $K^{+-}$ interaction with the nuclei of $^7$Li, $^9$Be, $^{12}$C, $^{27}$Al, $^{63}$Cu, $^{119}$Sn, $^{207}$Pb, $^{238}$U. Presented are complete cross sections of the interaction n in the range of 20-60 GeV, total cross sections of $\pi^+$, $\pi^-$, $K^+$, $K^-$, p tidle inelastic interaction with the energies 20-60 GeV; 30 GeV; 20-40 GeV; 20-40 GeV; 20-

40 GeV respectively. Data on the cross sections of inelastic scattering of particles with the nuclei obtained with the help of cosmic beams are also presented. Inelastic interactions and multiplicity of secondary particles are considered.

1569 (IPNO-TH—80-49, pp 1-7) **Effect of pion absorption on the elastic πd scattering.** Mizutani, T. [nd]. Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

We present the calculation of the elastic πd scattering which for the first time, extends from threshold to T/sub π/=260 MeV with a consistent inclusion of the intermediate π absorption. The overall agreement with recent experiments is good except above the Δ-resonance energy: the disagreement might possibly be due to our neglect of the controversial dibaryon resonances.

## 6513 Nuclear Properties And Reactions, A=6-19

*REFER ALSO TO CITATION(S) 1492, 1560, 1565, 1568*

1570 (ITEF—129(1979), pp 24-25) **Proton-nucleus interactions at intermediate energies accompanied by fast proton backwards emission.** Komarov, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1979. (In Russian). Dep. NTIS (US Sales Only).

From Seminar on nuclear theory; Moscow, USSR (Jan - May 1979).

1571 (KFTI—79-48, pp 30-33) **Influence of dynamic correlations and of nuclear structure effects on the form factors of excitation of light nuclei by fast electrons.** Fursaev, A.V.; Tartakovskii, V.K. (Kievskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

Calculated are the corrections to form factors of electron inelastic scattering by $^{6}$Li, $^{7}$Li nuclei with excitation of discrete states, the corrections being calculated in the many-particle shell model. The corrections obtained are caused by dynamic short-range correlations of the Yastrov type. These corrections are shown to be essential at large momentum transfers and much improve the agreement with experiment. The contribution of many-particle correlations is examined. The form factors of electron elastic and inelastic scattering by $^{12}$C have been calculated for the Woods-Saxon potential in the framework with intermediate coupling. It has been shown that a transition from the oscillatory potential to the Woods-Saxon one may considerably improve agreement with experiment in the range of small momentum transfers.

1572 (KFTI—79-48, pp 80-83) **Pion electroproduction on light nuclei.** Titov, Yu.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

Presented is a review of the experimental data on the electron inelastic scattering on light nuclei (sup(6,7)Li, sup(10,11)B, $^{12}$C) in the vicinity of the first pion-nucleon resonance. In the region of the (33)-resonance maximum, breaking of the momentum approximation has been shown not to exceed 15-20%. In the region of the cross section minimum between the peaks of quasi-elastic scattering and the (33)-resonance a considerable contribution comes from two-particle absorption of a virtual photon. The calculations performed in the phase volume approximation satisfactorily agree with the experimental data on a $^{7}$Li nucleus at the pion absorption probability equal to 0.7. A significant value of the pion absorption probability and the character of cross section dependence on the energy transfer do not exclude a possibility of arising a bound state of a pion and two nucleons.

1573 (KFTI—79-48, pp 89-94) **Instructiveness of spectra for photodisintegration products of light nuclei.** Cherkasov, A.S. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The final nuclei produced in a decay of giant resonance (GR) states in photoreactions on light nuclei are very often unstable to a decay in secondary particles. The specific features of the spectra of particles from the subsequent decay are discussed. It is noted that the singularities in the secondary particle spectra can be used for identifying the mechanism of the decay, primary and secondary particles in the experimental spectra, for obtaining data on the primary decay by means of spectra of the particles from the subsequent decay. Examined are also the singularities in the spectra of particles from direct three-particle decay and direct quasicluster three-particle decay of GR states. It is also noted that such spectra may provide data on the momentum distribution of nucleons and clusters in light nuclei.

1574 (KFTI—80-6, pp 12-13) **Study of the (γ, π$^{0}$p) reaction of $^{6}$Li, $^{12}$C and $^{16}$O nuclei in a wide range of transferred momentum.** Eponeshnikov, V.N.; Krechetov, Yu.F. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1980. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

Momentum distributions of protons in nuclei distorted by the final-state interaction have been obtained from the cross sections of the (γ,π$^{0}$p) reaction on $^{6}$Li, $^{12}$C and $^{16}$O nuclei measured up to 600 MeV/c momenta transferred to a residual nucleus. The distributions have been calculated within the framework of the model of quasifree photoproduction of mesons on nuclei and compared with the data of other papers. The comparison shows a qualitative agreement with the distributions which take into account of the effect of short-range dynamic correlations.

1575 (KFTI—80-6, pp 14-15) **Pion photoproduction on bound nucleons.** Glavanakov, I.V.; Stibunov, V.N. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1980. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The effect of nucleon coupling in a nucleus on the cross section of photoproduction of negative pions is studied. The results of measuring the differential cross section of the $^{12}$C (γ,π$^{-}$ p) $^{11}$C reaction in the Δ(1232) region within the framework of the impulse approximation and the nuclear shell model are used for obtaining the dσ/dΩ* cross section of the π$^{-}$ meson photoproduction on neutrons bound in a $^{12}$C nucleus. Within the measurement errors the cross section coincides in shape and in absolute magnitude with the cross section excerpted from the experimental data on the $^{2}$H(γ,π$^{-}$ p)p reaction. In comparing the cross sections, similar positions of maxima bound with Δ(1232) are provided by the kinematic definition of dσ/dΩ* by means of the momenta p vectorsub(π) and p vectorsub(p).

1576 (KFTI—80-6, pp 6-7) **Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV.** Belousov, A.S.; Vazdik, Ya.A.; Eliseev, A.N.; Malinovskij, E.I.; Rusakov, S.V.; Solov'ev, Yu.V.; Fomenko, A.I.; Sharejko, P.N. (AN SSSR, Moscow. Fizicheskij Inst.). 1980. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

π$^{0}$-meson photoproduction on $^{6}$Li, $^{12}$C, $^{27}$Al, $^{63}$Cu nuclei was studied in the 0+-5 deg angle range of meson escape for the 300+-50 MeV photon energy range. The measurements were taken on a bremsstrahlung beam generated by the "Pakhra" accelerator. Mesons were detected by two decay gamma-quanta. The dependence of the π$^{0}$-meson yield on the number of nucleons in a nucleus Y(A) obeys the law: Y(A)=Y(H)Asup(n), where n=0.907+-0.025, Y(H)=5.817+-0.372. The dependence obtained can be accounted for by assuming the presence of both coherent and noncoherent processes. Under this assumption the meson yield was approximated by the least square method.

1577 (KFTI—80-6, pp 43-44) **Effects of final-state interactions in the $^{12}C(e,e'p)^{11}B$ reaction.** Berezovoj, V.P.; Korchin, A.Yu.; Mel'nik, Yu.P.; Shebeko, A.V. 1980. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The effects of final-state interaction (FSI) on the formation of angular distributions of the $^{12}C(e,e'p)^{11}B$ reaction products is studied in the model of independent particles. The FSI of a knocked-on proton with a residual nucleus is considered within the framework of the optical model of nucleon-nuclear interaction with the potentials of two types: phenomenological ones obtained from analyzing the data on proton-nuclear elastic scattering, and the potential calculated on the basis of the Watson multiple scattering theory (local and nonlocal versions). The wave functions of the continuous spectrum in these potentials are calculated by the phase function method and the matrix inversion method. The results of calculations with the Watson potential have been shown to agree with the experimental data on the cross sections of the $^{12}C$ (e,e'p) reaction nucleus better, than in other considered models of the optical potential.

1578 (KFTI—80-6, pp 39-42) **Cross section of electron elastic scattering with $^{12}C$ nucleus as a reference standard for relative measurements.** Dolbilkin, B.S.; Kondrat'ev, R.L.; Lisin, V.P. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1980. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The results of measurements of the absolute cross sections of the electron elastic scattering with a $^{12}C$ nucleus in the range of transferred momenta q=0.193-0.623 $Fm^{-1}$ are presented. A root-mean-square radius of carbon is determined <rsup(2)>sup(1/2)=2.45+-0.025 Fm. Experimental and theoretical papers on the elastic scattering by $^{12}C$ have been reviewed. From this review it follows that the cross section of elastic scattering with carbon can be used as a reliable reference standard for performing relative measurements in electron scattering.

1579 (TRI—79-1, pp 124-127) **$(K^-,\pi^-)$ strangeness exchange reaction on $^6Li$, $^7Li$, and $^9Be$.** Bruckner, W.; Faessler, M.A.; Ketel, T.J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)) (and others). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

The $\Lambda^6Li$, $\Lambda^7Li$, and $\Lambda^9Be$ hypernuclear spectra have been obtained by means of the $(K^-,\pi^-)$ strangeness exchange reaction on $^6Li$, $^7Li$, and $^9Be$. The kaon momentum was either 720 MeV/c or 790 MeV/c. The pions were detected at 0° by the SPES II spectrometer and the overall resolution was 2 MeV. An independent particle model gives good account of the hypernuclear spectra, where the strongly populated states are due to recoilless transitions.

1580 (TRI—79-1, pp 128-132) **Excited states in light hypernuclei from $(K^-,\pi^-)$ reactions.** Auerbach, N. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy); Van Giai, N. (Institut de Physique Nucleaire, Orsay, France). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

In $\Lambda^9Be$ the strength S(E) shows a broad structure with its maximum at B$\Lambda$ = -5 MeV and a width (FWHM) GAMMA = 7 MeV. This structure is built mainly on the (1p)$\Lambda$(1p)sub(N)sup(-1) configuration and its width comes from that of the $\Lambda$ single particle resonance. At higher excitation energy the bound (1s)$\Lambda$(1s)sub(N)sup(-1) configuration gives rise to a narrow state at B$\Lambda$ = -15.5 MeV with a width GAMMA = 500 keV. Comparison with experimental data suggests that the observed width of the structure at lower excitation energy could be almost entirely attributed to the $\Lambda$ escape width. On the other hand, the width of the state seen at higher excitation energy is much larger than the calculated GAMMA and therefore it consists mainly of the damping width of the 1s neutron hole. Similar results are obtained for the nuclei $\Lambda^6Li$ and $\Lambda^7Li$.

1581 (TRI—79-1, pp 133-135) **Possible observation of a $\gamma$-transition in the $\Lambda^8Li$ hypernucleus.** Bedjidian, M.; Descroix, E.; Grossiord, J.Y. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

The $\gamma$-spectra induced by stopped $K^-$ mesons in $^9Be$ target were obtained in coincidence with the accompanying charged pions. The $\gamma$-line at (1.22 +- 0.04)-MeV observed with the 44 MeV charged pions was tentatively ascribed to a $\gamma$-transition in $\Lambda^8Li$ hypernucleus. Some interpretation of this line in a frame of the shell-model approximation of the $\Lambda^8Li$ levels is discussed.

1582 (TRI—79-1, pp 136-139) **Search for $\Sigma$ hypernuclei by means of the strangeness-exchange reactions $(K^-,\pi^-)$ and $(K^-,\pi^+)$.** Bruckner, W.; Faessler, M.A.; Ketel, T.J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

In the $(K^-,\pi^-)$ reaction performed at 720 MeV/c on $^9Be$ and $^{12}C$, a narrow structure appears around 80 MeV excitation in the hypernuclear spectra, precisely where $\Sigma$ hypernuclear states could be expected. Especially in $^9Be$ one finds a structure very similar to the $\Lambda$ hypernuclear states, with peaks narrower than 8 MeV. Those are nearly bound states of $\Lambda^0$ in the nucleus. The spectrum obtained by the $(K^-,\pi^+)$ reaction on $^9Be$ also shows a structure which could be due to nearly bound states of $\Lambda^-$ in the nucleus.

1583 **Bruckner-Hartree-Fock as a starting point for the description of excited states in nuclei.** Faessler, A. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). pp 4.3.1-4.3.27 of Molecular physics and quantum chemistry: into the 80's. Burton, P.G. (ed.). Wollongong, Australia; University of Wollongong (1980).

From Conference on molecular physics and quantum chemistry; Sydney, Australia (17 Feb 1980).

Starting from a realistic nucleon-nucleon (NN) interaction fit to the NN phase shifts an the deuteron data the Bruckner-Hartree-Fock (BHF) theory is used to construct an approximate expression for the total ground state energy of $^{16}O$. This energy is a functional of the density matrix E (rho). Using the Landau prescription the first derivative of this functional deltaE/ delta(rho) yields the HF Hamiltonian with several rearrangement terms normally not included in the BHF approach. The BHF problem including these terms is solved for $^{16}O$. In a second step the particle-hole ph-interaction is obtained for a Random-Phase (RPA) calculation using again the Landau prescription as the second derivative delta$^2$E/delta(rho)$^2$. In this way the excited states of $^{16}O$ are investigated. A proof of the Landau prescription for the ph force is found in case of the Tamm-Dancov approximation (TDA). It is shown that it yields an overcounting for the RPA which in lowest order can be corrected.

## 6514 Nuclear Properties And Reactions, A=20-38

*REFER ALSO TO CITATION(S) 1568, 1573, 1576*

1584 (KFTI—79-40, pp 5-6) **Combined analysis of the angular correlations in the (p,$\gamma$) and (p,p'$\gamma$) reactions.** Kachan, A.S.; Kostin, V.Ya.; Kopanets, E.G. 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

A method is proposed for determining quantum characteristics of states based on a simultaneous analysis of angular distributions of gamma-rays from the (p,$\gamma$) and (p,p'$\gamma$) reactions. The analysis is carried out in the representation of statistical tensor and total angular momentum. The spin-resonance states and coefficients of mixing in multipolarities of gamma-transitions $\delta_i$ are determined by minimizing the coefficient which takes account of the divergence in experimental and calculation values. The measurement and analysis of angular distributions have been performed for the $^{29}Si(p,\gamma)^{30}p$ and $^{29}Si(p,p'\gamma)^{29}Si$ reactions for the resonance at 2605 keV. The following results are obtained for the inelastic channel: for the spin-resonance state Jsub(res)=2, $\delta_i$=2.1+-0.7.

1585 (ZfK—410, pp 147-156) **First results in evaluation of neutron nuclear data for Si.** Hermsdorf, D.; Neumann, L. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Jan 1980. Dep. NTIS (US Sales Only).

From 9. international symposium on the interaction of fast neutrons with nuclei; Gaussig, German Democratic Republic (26 Nov 1979).

The nuclear data evaluation group of the Technical University Dresden is engaged in the evaluation of a complete file for Si including all neutron induced reaction cross sections, angular distributions and emission spectra for particles and γ-quanta up to 20 MeV neutron incidence energy. The present contribution is aimed at (1) comments on the reliability of recommended data files for Si; (2) problems in application of reaction models for cross section calculations; and (3) interpretation of experimental data in the frame of different reaction models.

## 6515 Nuclear Properties And Reactions, A=39-58

*REFER ALSO TO CITATION(S) 1573*

1586 **Collective bands of positive parity states in (FP) shell nuclei.** Ahalpara, D.P.; Bhatt, K.H. (Physical Research Lab., Ahmedabad (India)). pp 26-29 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

The collective bands of positive parity states in sup(41,43)Ca, sup(43,45,47)Sc, sup(47,48,49)V and sup(51)Mn nuclei in the deformed Hartree-Fock scheme have been studied using one-hole configurations which involve excitation of a particle from (sd) shell to (fp) shell. Modified Kuo Brown effective interaction has been used. The interaction of a hole in (sd) shell with a particle in (fp) shell is generated by using the modified surface delta interaction (MSDI). The collective bands of states are in general reasonably well reproduced by the effective interactions. Using the effective charges esub(p) = 1.33 e and esub(n) = 0.64 e, a fairly good agreement for E(2) transitions is obtained. The calculated M(1) transition strengths are slightly higher compared to experiment. The results for $^{41}$Ca, $^{43}$Sc and $^{49}$V nuclei are presented.

## 6516 Nuclear Properties And Reactions, A=59-89

*REFER ALSO TO CITATION(S) 1568, 1576*

1587 (KFTI—79-40, pp 3-4) **Proton inelastic scattering by sup(72,74)Ge nuclei.** Shebeko, K.V.; Nemashkalo, B.A.; Storizhko, V.E. 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

Cross sections of the sup(72,74)Ge lower level excitation have been measured (E=835 keV($2^+$)-$^{72}$Ge and E=598 keV($2^+$)-$^{74}$Ge) in the (p,p'γ) reaction in the range of proton energies 1.5-3 MeV. The (p,p'γ) cross sections at E=3.0 MeV are equal: 30.5 μb/sr for $^{72}$ Ge and 53.9 μb/sr for $^{74}$ Ge. The experimental cross sections are compared with the calculation data. The experimental cross sections are compared with the calculation data. The experimental values for B(E2) available in literature have been employed for calculating the Coulomb excitation cross section. It is shown that cross sections measured can be practically completely described by Coulomb nuclear excitation. The contribution of compound nucleus production is negligible.

1588 (OUP—81-09, pp 20-24) **Search for anti-aligned states in the A approximately 75 region.** Rekstad, J.; Ingebretsen, F. (Oslo Univ. (Norway). Fysisk Inst.); Loevhoeiden, G.; Lien, J.R.; Berg, E. (Bergen Univ. (Norway). Dept. of Physics); Hammeren, E.; Jaeskaelainen, M.; Liukkonen, E. (Jyvaeskylae Univ. (Finland). Dept. of Physics). [nd]. Dep. NTIS (US Sales Only).

In Nuclear physics group report, January 1 to December 31, 1980.

## 6517 Nuclear Properties And Reactions, A=90-149

*REFER ALSO TO CITATION(S) 1568, 1592, 1603*

1589 (JINR—D-4-80-385, pp 337-356) **Nucleon association effects in reactions at medium energies.** Komarov, V.I. 1980. (In Russian). Dep. NTIS (US Sales Only).

From International school on nuclear structure; Alushta, USSR (14 Apr 1980).

Discussed are experiments on investigations into interaction of mean energy protons with small-nucleon groups in nuclei. Quasi-elastic knockout of nuclear fragments in hard collisions of fast particles with nucleus clusters is considered. As hard collisions understood are such collisions where the increase in invariant mass of nucleus nucleon group occurs. Analysis data show that in the above quasi-elastic processes at mean energies observed is distinct manifestation of freedom degrees of nuclear substance resulted from excited nucleons. Inclusive backward emission of fast nucleons has been studied for hard collisions of nucleons and nucleon group in nucleus for processes, where nucleons of infinite state are not bound as a nucleus. It is noted that data on backward emission of fast nucleons point out directly to a certain universality in nucleon clusters behaviour at their high excitation levels. Analyzed are data on two- and three-particle differential cross sections of proton emission in hard collisions. It is also noted that exclusive in vestigation into angular distribution of initiating particles scattered by a cluster in hard collisions can be used as an direct method for measuring linear dimensions of the region of interaction with cluster.

1590 **Decay properties of neutron-rich isotopes of Rb (Z = 37) to Tc (Z = 43) and the mass-energy surface around A = 100. Chapter 5.** Peuser, P.; Otto, H. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie); Nyman, G.; Roeckl, E. (GSI, Darmstadt (Germany, F.R.)). pp 288-296 of Nuclear spectroscopy of fission products. von Egidy, T. (ed.). Bristol, England; The Institute of Physics (1980).

From Workshop on nuclear spectroscopy of fission products; Grenoble, France (21 May 1979).

Neutron-rich Rb isotopes were investigated by decay spectroscopy using a mass separator on-line to the TRIGA reactor at Mainz. Multiscaling measurements of β-delayed neutrons yielded half-lives for $^{98}$Rb (112 +- 4 ms), $^{99}$Rb (59 +- 4 ms) and $^{100}$Rb (51 +- 17 ms). For $^{99}$Rb, the β-delayed neutron emission probability was determined to be 0.15 +- 0.03 and the independent yield from $^{235}$U fission was found to be (2.5 +- 1.3) x $10^{-6}$. The mass excesses derived from Q/sub 2n/ systematics, the structures of which are characterised by an interplay between a neutron-subshell closure at N = 56 and the possible onset of deformation around A = 100.

1591 (IPNO-TH—80-49, pp 1-17) **Reaction mechanisms in coherent nuclear photoproduction.** Lazard, C. [nd]. (In French). Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

Nuclear coherent pion photoproduction is studied. Pion rescattering and propagation effects inside nucleus and mesic exchange current effects are discussed. Influence of nuclear wave functions and Fermi motion is presented.

## 6518 Nuclear Properties And Reactions, A=150-189

*REFER ALSO TO CITATION(S) 1492, 1568, 1596*

1592 (INP—1014/PL, pp 43-48) **High spin isomeric states in $^{152}$Dy.** Beck, F.; Gehringer, C.; Merdinger, J.C.; Vivien, I.F. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires); Bozek, E.; Styczen, J. 1978. B. Order Number DE81700032.

From 16. winter school; Bielsko-Biala, Poland (20 Feb 1978).

In this work the gamma deexcitation of $^{152}$Dy obtained from $^{140}$Ce($^{16}$O,4n)$^{152}$Dy was investigated. New isomeric state of $^{152}$Dy nucleus was found by measuring γ-γ coincidence spectra.

1593 (OUP—81-09, pp 49-51) **Negative parity states of $^{151}$Sm in the particle-rotor model with exact treatment of the pairing and recoil term.** Henriquez, A.; Rekstad, J.; Engeland, T. [nd]. Dep. NTIS (US Sales Only).

In Nuclear physics group report, January 1 to December 31, 1980.

1594 (OUP—81-09, pp 52-54) **Particle-rotor model analysis of $^{163}$Er.** Engeland, T. [nd]. Dep. NTIS (US Sales Only).

In Nuclear physics group report, January 1 to December 31, 1980.

1595 (OUP—81-09, pp 39-40) **Gamma multiplicity of the decay of highly excited low spin states in $^{157}$Gd.** Rekstad, J.; Ingebretsen, F.; Messelt, S.; Midttun, G.; Skaali, B. (Oslo Univ. (Norway). Fysisk Inst.); Thorsteinsen, T.F.; Loevhoeiden, G.; Lien, J.R. (Bergen Univ. (Norway). Dept. of Physics). [nd]. Dep. NTIS (US Sales Only).

In Nuclear physics group report, January 1 to December 31, 1980.

## 6519 Nuclear Properties And Reactions, A=190-219

*REFER ALSO TO CITATION(S) 1568*

1596 (JINR-D—4-80-385, pp 261-276) **Fast charged-particle emission in heavy-ion reactions.** Oganesyan, Yu.T. 1980. (In Russian). Dep. NTIS (US Sales Only).

From International school on nuclear structure; Alushta, USSR (14 Apr 1980).

The problem of charged-particle yield in heavy-ion reactions is discussed. The sup(20, 22)Ne and $^{40}$Ar ion reactions on $^{159}$Tb, $^{181}$Ta, $^{197}$Au and $^{232}$Th nuclei are considered as an example. Ion beam energy varied from 5.5 to 10 MeV nucleon. Given are energy spectra of alpha particles emitted in the above reactions. Experimental data show that when interacting ions with various nuclei from A=150 to A=232 observed is escape of energetic charged particles predominantly in the incident beam direction. The alpha particle spectrum has a distinctive type of a curve with a maximum at E approximately 30-40 MeV and exponential decrease in the high energies region. Analyzing the experimental results (spectra measurement, angular distribution of alpha particles, dependence of reaction cross section on ion energy etc.) a number of assumptions can be made on a possible alpha particle emission mechamism. Measurement of neutron spectrum in heavy ion reactions as well as measurement of gamma rays in coincidence with different energy alpha particles result in the values of temperature and angular momentum of initial nucleus states directly related to fast charged particle emission mechanism. The set of all the data obtained permits to suggest that energetic alpha particle escape takes place in the direct process proceeding in a surface layer of interacting nuclei.

## 6520 Nuclear Properties And Reactions, A=220 And Above

*REFER ALSO TO CITATION(S) 1614*

1597 (INDC(CCP)—135/LN, pp 11-22) **Measurements and evaluations of nuclear data on actinide isotopes. Review of papers published by Soviet scientists during 1975-1978.** Kulakov, V.M.; Sokolovskii, L.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Aug 1979. Dep. NTIS (US Sales Only).

In Translations of contributed Soviet papers submitted to the May 1979 IAEA advisory group meeting on transactinium nuclear data.

The measurements of the nuclear decay of actinide isotopes and the evaluation of the radioactive properties of nuclide with the mass 242 is discussed in this paper.

1598 (INDC(CCP)—135/LN, pp 25-26) **New measurements of partial decay half-lives of the isomeric state of / sup 242m/Am.** Zelenkov, A.G.; Pchelin, V.A.; Rodionov, Yu.F.; Chistyakov, L.V.; Shubko, V.M. Aug 1979. Dep. NTIS (US Sales Only).

In Translations of contributed Soviet papers submitted to the May 1979 IAEA advisory group meeting on transactinium nuclear data.

The half-life of the isomer /sup 242m/Am and the partial alpha decay half-life were measured and found to be 141 +- 2 years and (3.12 +- 0.05) x $10^4$ years respectively.

1599 (INDC(CCP)—135/LN, pp 27-33) **Half-life of the $(1/2)^+$-isomer of $^{235}$U.** Zhudov, V.I.; Kulakov, V.M.; Odinov, B.V. Aug 1979. Dep. NTIS (US Sales Only).

In Translations of contributed Soviet papers submitted to the May 1979 IAEA advisory group meeting on transactinium nuclear data.

The apparatus and methodology developed for measuring the half-life of the $(1/2)^+$-isomer of $^{235}$U are described. Methods of accumulating the isomer and the technique for detecting low-energy conversion electrons are discussed. For accumulation of the isomer on gold, uranium dioxide and uranium tetrafluoride bases the half-lives obtained were 25.0 +- 0.5 min, 26.8 +- 0.7 min and 26.5 +- 0.7 min respectively.

1600 (INDC(CCP)—135/LN, pp 35-41) **Conversion electron spectrum of the $(1/2)^+$ isomer of $^{235}$U.** Zhudov, V.I.; Zelenkov, A.G.; Kulakov, V.M.; Mostovoi, V.I.; Odinov, B.V. Aug 1979. Dep. NTIS (US Sales Only).

In Translations of contributed Soviet papers submitted to the May 1979 IAEA advisory group meeting on transactinium nuclear data.

The differential conversion electron spectrum of the $(1/2)^+$ isomer of $^{235}$U was measured. Three lines were detected in the spectrum which correspond to conversion by the (6p/sub 1/2/)$^2$, (6p/sub 3/2/)$^4$ and 6d electron shells of a uranium atom. The excitation energy of the isomer was determined as (76+-2) eV.

1601 (INDC(CCP)—150/LJH, pp 1-41) **Evaluation of nuclear data for $^{242}$Pu in the region of resolved and unresolved resonances ($10^{-5}$ eV-200 keV).** Antsipov, G.V.; Bakhanovich, L.A.; Kon'shin, V.A.; Maslov, V.M.; Morogovskii, G.B.; Sukhovitskii, E.Sh.; Porodzinskii, Yu.V. Jul 1980. Dep. NTIS (US Sales Only).

In Evaluation of nuclear data for $^{242}$Pu in the $10^{-5}$ eV-15 MeV neutron energy region. Translation of a collection of scientific papers published by the Heat and Mass-Exchange Institute of the Byelorussian Academy of Sciences in Minsk in 1979.

Neutron data for $^{242}$Pu are evaluated in the resolved and unresolved resonance regions. In the $10^{-5}$-1 keV region, the evaluation is based on the Breit-Wigner resonance parameters. In the unresolved resonance region, all types of average cross-section and width are calculated. The authors quote average parameters and cross-sections in the 1-200 keV region and analyse the errors in the evaluated data.

1602 (INDC(CCP)—150/LJH, pp 92-109) **Evaluation of the characteristics of secondary neutrons and gamma rays in the interaction between neutrons and the $^{242}$Pu nucleus.** Zenevich, V.A.; Klepatskii, A.B.; Krasin, A.K.; Maslov, V.M.; Porodzinskii, Yu.V. Jul 1980. Dep. NTIS (US Sales Only).

In Evaluation of nuclear data for $^{242}$Pu in the $10^{-5}$ eV-15 MeV neutron energy region. Translation of a collection of scientific papers published by the Heat and Mass-Exchange Institute of the Byelorussian Academy of Sciences in Minsk in 1979.

On the basis of calculations by various theoretical models the following characteristics of secondary neutrons and gamma rays for the $^{242}$Pu nucleus have been evaluated: fission neutron spectrum, value of anti nu for $^{242}$Pu, the angular and energy distributions of neutrons from the (n,n), (n,n'), (n,2n), (n,3n), (n,n'f) and (n,2nf) reactions and the energy spectrum of the secondary gamma quanta. The group constants for $^{242}$Pu have been obtained. A printout of the complete file of evaluated nuclear data for $^{242}$Pu in the ENDF/B format is reproduced.

**1603** **Fission properties of very heavy nuclei produced in deep-inelastic collisions.** von Harrach, D.; Glaessel, P.; Civelekoglu, Y.; Maenner, R.; Specht, H.J.; Wilhelmy, J.B. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Freiesleben, H.; Hildenbrand, K.D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). pp 575-585 of Physics and chemistry of fission 1979. Vol. 1. Proceedings of an international symposium organized by the IAEA and held at Juelich, 14-18 May 1979. Vienna, Austria; IAEA (1980).

From IAEA symposium on physics and chemistry of fission; Julich, F.R. Germany (14 May 1979).

Kinematically complete experiments have been performed on the three-body exit channels in the reactions 7.5 MeV/u $^{238}$U on $^{90}$Zr, $^{238}$U and $^{248}$Cm to investigate the fission properties of nuclei with a vanishing liquid-drop fission barrier. Thus far, no evidence was found for true instantaneous three-body break-up of the collision system. Instead, a seemingly sequential fission pattern in the sense of unperturbed fission-fragment kinetic energies (as found before for lighter systems) is observed even for the heaviest elements. However, a considerable broadening of the fragment mass distributions as well as angular distributions incompatible with the usual saddle-point concept are also observed in this region. Possible explanations in terms of non-equilibrium processes or a revision of the equilibrium liquid-drop picture near instability are discussed.

## 6530 Nuclear Theory

*REFER ALSO TO CITATION(S) 1529*

**1604** (IAEA-SMR—43, pp 59-95) **Applied neutron resonance theory.** Froehner, F.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

Utilisation of resonance theory in basic and applications-oriented neutron cross section work is reviewed. The technically important resonance formalisms, principal concepts and methods as well as representative computer programs for resonance parameter extraction from measured data, evaluation of resonance data, calculation of Doppler-broadened cross sections and estimation of level-statistical quantities from resonance parameters are described.

**1605** (IAEA-SMR—43, pp 97-120) **Theoretical aspects of the optical model.** Mahaux, C. (Liege Univ. (Belgium). Inst. de Physique Nucleaire). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

We first recall the definition of the optical-model potential for nucleons and the physical interpretation of the main related quantities. We then survey the recent theoretical progress towards a reliable calculation of this potential. The present limitations of the theory and some prospects for future developments are outlined.

**1606** (IAEA-SMR—43, pp 121-148) **Matrix methods in the optical model. Spherical nuclei.** Salvy, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

The calculable R matrix theory developed by Lane and Robson by using the Bloch boundary condition operator L is shown to be useful in the frame of practical aspects of the optical model. We first recall the general formalism. We then apply it to spherical nuclei and develop practical methods for constructing all the elements of the matrices which are to be inverted. A non local nuclear potential of the folding type is examined as a possible alternative or improvement of the conventional phenomenological Woods-Saxon potential. From a more fundamental point of view, matrix methods are also shown to be adapted to the treatment of Hartree-Fock type real parts. Finally the applicability of such matrix methods for practical evaluation purposes is illustrated with some simple examples. Other possible developments are suggested.

**1607** (IAEA-SMR—43, pp 149-164) **Phenomenological optical potentials and optical model computer codes.** Prince, A. (Brookhaven National Lab., Upton, NY (USA)). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

An introduction to the Optical Model is presented. Starting with the purpose and nature of the physical problems to be analyzed, a general formulation and the various phenomenological methods of solution are discussed. This includes the calculation of observables based on assumed potentials such as local and non-local and their forms, e.g. Woods-Saxon, folded model etc. Also discussed are the various calculational methods and model codes employed to describe nuclear reactions in the spherical and deformed regions (e.g. coupled-channel analysis). An examination of the numerical solutions and minimization techniques associated with the various codes, is briefly touched upon. Several computer programs are described for carrying out the calculations. The preparation of input, (formats and options), determination of model parameters and analysis of output are described. The class is given a series of problems to carry out using the available computer. Interpretation and evaluation of the samples includes the effect of varying parameters, and comparison of calculations with the experimental data. Also included is an intercomparison of the results from the various model codes, along with their advantages and limitations.

**1608** (IAEA-SMR—43, pp 187-203) **Theories and approximations of nuclear level densities.** Ramamurthy, V.S. (Bhabha Atomic Research Centre, Bombay (India)). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

Outstanding experimental features of nuclear level densities are their extremely rapid increase with excitation energy and dependence on nuclear shell and pairing effects. The rapid increase of the number of levels with energy is a general characteristic of any system with many degrees of freedom. In the case of a Fermion system like a nucleus, these degrees correspond to the elementary excitations with additive energies. The mathematical formulation of the level density problem for such a system is well known in statistical mechanics. The first part contains a detailed discussion of the method of calculation of nuclear level densities with particular emphasis on the partition function approach. Some of the recent generalizations of the method to include the effects of residual interactions between the nucleons such as the pairing interaction are also discussed. In the second part we give a brief description of some of the recent calculations of level densities starting from shell model single particle level schemes. The possible sources of error in such calculations of absolute level densities are also discussed. In the third part, two recently developed semiempirical level density formulae are described which retain the simplicity of approximate analytical formulae but at the same time include nuclear shell effects in a more realistic manner. A brief discussion of some of the open problems is also given.

**1609** (IAEA-SMR—43, pp 205-230) **Parameter systematics for statistical theory calculations of neutron reaction cross-sections.** Reffo, G. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Centro di Calcolo). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

The problem of determining the parameters relevant to statistical model calculation of cross sections failing experimental information is reviewed from the point of view of the evaluation of nuclear data for reactor needs. The level density problem in the whole energy range of interest is considered with emphasis on the systematic behaviour of the level density parameters "a", nuclear temperature T and matching energy Usub(x). A consistent determination of spin cut-off parameter is discussed. The results of radiative decay width calculations according to most familiar approximations are investigated as well as its energy spin and parity dependence. Use of the Brink-Axel hypothesis is suggested and to this end the systematic trend of giant resonance parameters is shortly illustrated. The systematic behaviour of neutron capture cross sections at lower energies as predicted by the statistical model is

shown at 25 keV. The degree of uncertainty in interpolating parameters on the systematic curves is given.

1610 (IAEA-SMR—43, pp 255-282) **Foundations and models of pre-equilibrium decay.** Bunakov, V.E. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

A review is given of the presently existing microscopic, semi-phenomenologic and phenomenologic models used for the description of nuclear reactions. Their advantages and drawbacks are analyzed. A special attention is given to the analysis of pre-equilibrium decay phenomenological models based on the use of master equations (time-dependent versions of exciton models, intranuclear cascade, etc.). A version of the unified theory of nuclear reactions is discussed which makes use of quantum master equations for finite open systems. The conditions are formulated for the derivation of these equations from the time-dependent Schroedinger equation for the many-body problem. The various models of nuclear reactions used in practice are shown to be approximate solutions of master equations for finite open systems. From this point of view the analysis is carried out of these models' reliability in the description of experimental data. Possible modifications are considered which provide for better agreement between the different models and for the more exact description of experimental data.

1611 (IAEA-SMR—43, pp 283-291) **Application of pre-equilibrium decay models to the calculation of neutron reaction data.** Seeliger, D. (Technische Univ., Dresden (German Democratic Republic)). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

The basic assumptions of the concept of pre-equilibrium decay during the initial phase of nuclear reactions in the framework of the phenomenological exciton model are briefly reviewed. Recent approaches to the problem of angular distribution calculation are discussed.

1612 (IAEA-SMR—43, pp 293-304) **Absolute values of inelastic neutron scattering cross-sections calculated with account taken of the pre-equilibrium mechanism.** Jahn, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

Absolute values of secondary energy-dependent inelastic neutron scattering cross sections can be calculated either with the master equation pre-equilibrium formalism of Cline and Blann or with Blann's more recent geometry-dependent hybrid model. The master equation formalism was used at Dubna and Dresden to reproduce experimental results for 14 MeV incident energy. The geometry-dependent hybrid model was used at Karlsruhe to cover for a number of materials the whole range from 5 to 14 MeV incident energy and to reproduce smoothed experimental spectra at 7.45 and 14 MeV. Only the geometry-dependent hybrid model accounts for scattering in the diffuse nuclear surface and thus for a certain average over the direct interaction. It is also free of any fit parameters other than those of the usual optical model. The master equation calculations, on the other hand, are based on nucleon-nucleon scattering cross sections inserted into the high-energy approximation of Kikuchi and Kawai for the intranuclear transition rate. Other approaches require either mass- or energy-dependent or more global fit parameters for a satisfactory reproduction of experimental results, but a genuine prediction of the incident-energy dependence of the inelastic neutron cross section, especially below 14 MeV, is needed for transport and shielding calculations for instance in connection with fusion reactor design studies.

1613 (IAEA-SMR—43, pp 327-352) **Fundamentals of the double-humped fission barrier.** Brack, M. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

We review the development of the theory of the fission barrier over the past forty years. Special emphasis is put on the shell-correction method of Strutinsky and its foundation and numerical verification from microscopical Hartree-Fock calculations. The different practical realisations of the method and its applications to the calculation of deformation energy surfaces are reviewed. The influence of the different shape degrees of freedom of the nucleus on the form of the fission barrier is discussed. Finally, we summarize some more recent developments concerning both experimental and theoretical aspects of the double-humped fission barrier.

1614 (IAEA-SMR—43, pp 353-415) **Fission barrier theory and its application to the calculation of actinide neutron cross-sections.** Lynn, J.E. (UKAEA Atomic Energy Research Establishment, Harwell). Mar 1980. Dep. NTIS (US Sales Only).

From Course on nuclear theory for applications; Trieste, Italy (17 Jan - 10 Feb 1978).

The lectures discuss the possibilities and realisations of applying nuclear fission theory to the calculation of unknown nuclear data required for applications, principally in the nuclear power field. A brief description of the fundamentals of fission theory, the nature of the potential energy surface in the deformation plane, and of the inertial tensor, is given, and the accuracy of the theoretical calculations is discussed. It is concluded that it is impracticable to obtain required quantities such as neutron cross-sections from such fundamental calculations at present. On the other hand the fundamental theory reveals a wealth of phenomenological aspects of the fission process which can be incorporated into nuclear reaction theory. It is then shown how reaction theory thus extended to take correct account of the structured ("double-humped") fission barrier can be used to parametrise the barrier by analysis of experimental data, and subsequently to calculate new data. Descriptions of computer programmes and illustrations of the application of the methods to actual physical examples are included in this account.

1615 (JINR—D-4-80-385, pp 357-376) **Possibility of multiquark configuration existence in nuclei.** Luk'yanov, V.K.; Titov, A.I. 1980. (In Russian). Dep. NTIS (US Sales Only).

From International school on nuclear structure; Alushta, USSR (14 Apr 1980).

Considered is a possibility for Nq multiquark configurations appearance with the number of quarks N=6, 9, 12 in nuclei or in systems appearing in nuclear reactions. Properties of Nq systems are discussed and the results of calculation of 6q-configurations energy for various combinations of quark clusters are presented. For values of orbital momentum l not equal to 0, dibaryon states with strangeness S have been calculated. The problem of deuteron with provision for 6q-configurations has been investigated. It is shown that total multiquark admixture in deuteron must constitute approximately 1% slightly changing for different potentials. Studied were nucleon-nucleon interactions and elastic eA reactions from the point of view of 6q systems. It is noted that experimental resonances can be interpreted as excited states. A problem related to estimating the width of similar resonances is considered. It is concluded that at present in vestigation into multiquark configurations in nuclei and nuclear substance has been converted into one of the directions in nuclear physics.

1616 (JINR-D—4-80-385, pp 168-188) **Pion-nucleus interaction and nuclear structure (experiment).** Kurepin, A.B. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1980. (In Russian). Dep. NTIS (US Sales Only).

From International school on nuclear structure; Alushta, USSR (14 Apr 1980).

On the base of using modern optical potential of the microscopic theory of interaction between pions and atomic nuclei analyzed are the latest experimental data on elastic and inelastic pion scatterings, total interaction cross section with oriented nuclei and charge-exchange reaction. Experimental data on elastic and inelastic pion scatterings at energies below 100 MeV and above 400 MeV are satisfactorily described within the framework of the microscopic approach. Measurement of total pion scattering cross section on oriented nuclei permits to determine possibility for proton and neutron distributions in nuclei, the presence of pion condensate which must be revealed in the cross section due to the formation of alin-

ear statical pion field. Experimental data show that the investigation into pion-nucleus interaction permits to obtain new data on the nucleus structure.

1617 (JINR-D—4-80-385, pp 297-336) **Nuclear collisions at intermediate energies.** Scott, D.K. (Michigan Univ., Ann Arbor (USA); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1980. Dep. NTIS (US Sales Only).

From International school on nuclear structure; Alushta, USSR (14 Apr 1980).

In lectures the heavy-ion reactions at intermediate energies between 10 and 200 MeV per nucleon are discussed. The first lecture presents a general scheme for a heavy-ion reaction mechanism in terms of the participant-spectator model. In the framework of the model after a collision, the non-overlapping parts of a beam and target nuclei, called the spectators, continue along straight-line trajectories. In the overlap region strong interactions between the nucleons cause fragments to be emitted over a wide angular range. These participants constitute the nuclear fireball. In the second lecture the foundation of existing hot-spot zones in the region of 20 MeV/nucleon is given. Some deviations from the model are considered in the third lecture. It is concluded that intermediate energy collisions allow to study exotic nuclei very far removed from the valley of stability.

1618 (KFTI—79-40, pp 25-28) **Program for computation of cross section and analyzing power of deuteron stripping in the analog channel threshold by the distorted wave method.** Ustimenkov, K.F.; Zalyubovskii, I.I. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)); Deineko, A.S.; Storizhko, V.E. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

Fundamental formulas and the organization principle of the modified program are described for computating the differential cross section and the vector analyzing power of single-nucleon stripping reactions with allowance made for the analogue channel. Spin-orbital and isospin terms, aside from the central one, are taken into account in the optical potential. The maximum value of the orbital angular momentum of a captured particle, which can be accounted for in the program, is 2. Spins of the initial and final nuclei participating in the reaction may be arbitrary. The program has been realized in the M-222 computer language. The time required for calculating one angular distribution of the reaction products depends on the target-nucleus spin and on the orbital angular momentum of a captured particle and equals 30-60 min.

1619 (KFTI—79-40, pp 7-9) **Evaluation of the molecular ion yield in nuclear fragmentation experiments.** Cherkasov, A.S. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

Probabilities of molecular ion yield have been estimated in the experiments on fragmentation of atomic nuclei. Two possible mechanisms are considered which lead to a rather rigid correlation in velocity and direction of motion of the charged particle pairs - molecular ion components: 1) components of a pair with the energy of relative motion, not exceeding the energy of the molecular ion dissociation, arise as a result of in-flight decay of some quasistationary state produced in fragmentation; 2) pair correlation in velocity and direction of motion is a random nature, it results from the cascade mechanism of reaction. Formulas are obtained for estimating the probabilities of the mechanisms indicated.

1620 (KFTI—79-40, pp 15) **Definition of absolute differential cross sections in the case of using many-component targets.** Malakhov, I.Ya.; Deineko, A.S. 1979. (In Russian). Dep. NTIS (US Sales Only).

In General and nuclear physics.

It is shown that the method of determining partial thicknesses of multicomponent targets permits constituting a complete system of $n(n+1)$ equations, of which n equations are obtained on measuring the total thicknesses of nn-component targets, and $n^2$ equations are obtained when measured are the peak areas in the spectra of elastically-scattered charged particles or of particles from a reaction. The solution of this system yields $n^2$ values of partial thicknesses and n values of absolute differential cross sections of reactions of charged particles with target component nuclei.

1621 (KFTI—79-48, pp 45-46) **Correlation mechanism of NN pair electroproduction on nuclei.** Nagornyi, S.I.; Inopin, E.V. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The knock-out of nucleon-nucleon pairs with a large relative momentum from nuclei is considered. It has been shown that namely such processes may serve as a proton source in the kinematically forbidden region (KFR). The cross sections of the (e,e'p) reaction with proton detection in KFR are very much sensitive to the parameters and shape of the correlation function. In this connection, it is proposed that the (e,e'p) reaction should be investigated under conditions of anti-quasi-elastic kinematics in order to obtain data on short-range dynamic correlations in nuclei. The proton spectra calculated in the KFR are of a universal character, i.e., the spectrum shape does not practically depend on the nucleus number.

1622 (KFTI—79-48, pp 43-44) **Field model of photonuclear reactions.** Afonin, A.A.; Maksimenko, N.V.; Timoshin, S.I. (Gomel'skij Gosudarstvennyj Univ. (Byelorussian SSR)). 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

A model of photonuclear reactions in the region of giant resonance has been proposed. Under the assumption of finite scalar particles the model makes it possible to obtain an expression for the amplitude in an obvious form. An expression for the differential cross section is obtained. In the first approximation of the scalar model the photosplitting cross section has been found to be of a dipole character. The probability of nuclear splitting into one nucleon and a residual nucleus is higher, as compared to other versions. Maximum in the cross section is observed at the photon energy $\omega = 2$ epsilon and $\omega =$ lambda + Esub(isub(1)) + Esub(isub(2)), where lambda, epsilon is the binding energy of fragments for intermediate and final states respectively, Esub(isub(1)) and Esub(isub(2)) are the excitation energies of intermediate fragments.

1623 (KFTI—79-48, pp 53-54) **Problem of monopole resonance in nuclei.** Savitskii, G.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From Hadron electromagnetic interactions in the resonance energy range; Kharkov, Ukrainian SSR (30 May 1979).

The results of studies of the giant electric monopole resonance in atomic nuclei by means of electron, proton, deuteron and alfa-particle inelastic scattering have been reviewed. In most experiments the energy of this resonance is close to 80 Asup(-1/3) MeV, which practically coincides with the position of the giant dipole resonance.

1624 (TRI—79-1, pp 110) **Hadron-nucleus total cross sections in the quark-parton model.** Kopeliovich, B.Z.; Lapidus, L.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

1625 (TRI—79-1, pp 117-120) **Λ-nucleon potential and binding energy of the hypertriton.** Narumi, H.; Ogawa, K. (Hiroshima Univ. (Japan). Dept. of Physics); Sunami, Y. (Shimonoseki University, Yamaguchi, Japan). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

On the line of phenomenological approach to the Λ-nucleon interaction based on the meson-theoretical potential, the bound state of the hypertriton is searched by solving the Faddeev equation in the coordinate space. Our calculated result B sub(Λ) = 0.14 MeV of the Λ-separation energy for the ground state ($J = 1/2$) is in good agreement with the experimental value of 0.13+-0.05 MeV. The bound state of $J = 3/2$ cannot be confirmed by this method.

1626 (TRI—79-1, pp 121-123) **Qualitative discussion of the A=4 hypernuclear isodoublet.** Gibson, B.F. (Los Alamos Scientific Lab., NM (USA)); Lehman, D.R. (Georgetown Univ., Washington, DC (USA). Dept. of Physics). Dec 1979. Dep. NTIS (US Sales Only).

From Kaon factory workshop; Vancouver, Canada (13 Aug 1979).

The hypernuclear mass 4 isodoublet provides a curious set of binding for the J sup($\pi$)=$0^+$ ground states and J sup($\pi$)=$1^+$ excited states which one would like to understand in terms of the basic YN interactions. We discuss the qualitative understanding of the charge symmetry breaking in the ground state and ground-state excited-state separation in terms of exact 4-body equations and the effects of $\Lambda$N-$\Sigma$N coupling in the YN interaction.

1627 **Microscopic structure and group theory of the interacting boson model.** Lipkin, H.J. (Argonne National Lab., Evanston, IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA); Weizmann Inst. of Science, Rehovoth (Israel)). *Nuclear Physics [Section] A;* **350**: No. 1/2, 16-30(1 Dec 1980).

The chains of groups used in calssifying states of the IBM are compared with the chains used in a composite model with j = 3/2 fermion pairs. Many similarities are found, along with differences due to Pauli principle effects in continuum fermion pairs. The classifications are shown to be characterized by several different seniority numbers, which are physically similar but formally different in the two cases because fermion pair and boson pair states used to define seniority in each model correspond to single bosons and four-fermion clusters, respectively, in the other model. The SO(6) and SO(5) groups which define boson pair seniorities in the boson sextet model are isomorphic, respectively, to SU(4) and Sp(4) which have simple physical interpretations in fermion quartet models.

1628 **Intrinsic state for the interacting boson model and its relationship to the Bohr-Mottelson model.** Ginocchio, J.N.; Kirson, M.W. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Nuclear Physics [Section] A;* **350**: No. 1/2, 31-60(1 Dec 1980).

Within the interacting boson model, an intrinsic state is defined, in terms of quadrupole shape variables, from which all eigenstates of the interacting boson model can be projected by appropriately averaging over these shape variables and the orientations of the instrinsic state. With this intrinsic state, an energy surface and a Bohr Hamiltonian can be derived for any boson Hamiltonian in terms of these quadrupole variables.

1629 **Selfconsistent description of nuclei.** Faessler, A. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). pp 4.2.1-4.2.37 of Molecular physics an quantum chemistry: into the 80's. Burton, P.G. (ed.). Wollongong, Australia; University of Wollongong (1980).

From Molecular physics and quantum chemistry workshop; Wollongong, Australia (11 Feb 1980).

The selfconsistent description of nuclear properties, although it is a very powerful tool, is not as successful as in Atomic and Molecular Physics. This is connected with uncertainties in our knowledge about the Nucleon-Nucleon (N-N) interaction and with the short range and the strong nature of the internucleon force. Nevertheless methods based on the Hartree-Fock approach emerged in the last fifteen years as a powerful tool to understand nuclear structure. In this paper the author discusses the possibility of bridging the gap from meson-nucleon and the N-N interaction to nuclear data.

1630 **Evaluation of relativistic and nonrelativistic DWBA scattering amplitude using wave functions calculated with the help of Green's function.** Sarkar, S.; Khatun, S. (Indian Association for the Cultivation of Science, Calcutta. Dept. of Theoretical Physics). pp 152-154 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

Green's function method has been used to calculate the eikonal wave function and to evaluate DWBA amplitude to determine relativistic electron-nucleus scattering. For this purpose exact Green's function of propagator in terms of eikonal propagator both in the case of relativistic and non-relativistic projectiles has been expanded. Correction terms through third order in inverse momentum Ksup(-1) to the lowest order eikonal wave function have been calculated. Compact expression for all orders of Ksup(-1) and first order in potential strength has also been obtained. The methods developed here are applicable to elastic and inelastic scattering of nucleon or $\alpha$-particle by nucleus and relativistic electron scattering by deformed nucleus.

1631 **Multi-centre shell model.** Gupta, R.K. (Punjab Univ., Chandigarh (India). Dept. of Physics). pp 171-230 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21A. Invited talks. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

Recent results obtained for the shell-model application to the phenomenon of nuclear fission and heavy-ion collisions are reviewed. The inability of the Nilsson-type one-centre oscillator to give the scission configuration in fission prompted the introduction of two-centre shell model. Noting that in fission the compound nucleus already exists and in heavy-ion collisions it is formed as an intermediate step, a fragmentation theory has been developed using the two-centre shell model (in Stutinsky way) and the well-founded Cranking model. Treating the mass and charge asymmetries of the two fragments as dynamical coordinates in the Hamiltonian of the system, the time-dependent Schroedinger equation is solved under certain limiting conditions for both the fission and heavy-ion collision paths. The theory has met with a considerable success for both the binary fission yields and in suggesting methods for synthesizing new elements, including super-heavy elements, by fusing two heavy-ions. Extensions of the shell model to three and more centres have also been carried out since the fissioning of a heavy (compound) nucleus produced in heavy-ion collisions is observed recently. The trends of the present experimental data suggests that a complete description of both the nuclear fission and heavy ion collisions would, perhaps, require the nucleus as a multi-centre shell model - a really formidable task.

1632 **Nuclear many-body theories.** Tripathi, R.K. (Institute of Physics, Bhubaneswar (India)). pp 231-254 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21A. Invited talks. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

The current status of nuclear many-body theories is reviewed. These theories are classified into the classes : (i) perturbative and (ii) variational. In the first, one uses the Brueckner theory for infinite system or Brueckner-Hartree-Fock for a finite system. Amongst the variational theories, Jastrow variational principle is being used for infinite system. In denser systems, somewhat modified form - Fermi HyperNetted Chain (FHNC) theory is being used as well. A comparision of the recent results obtained by the different theories is made in case of infinite nuclear matter.

1633 **Effective interactions for nuclear structure.** Joshi, K.P. (Indore Univ. (India). Dept. of Physics). pp 255-274 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21A. Invited talks. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

A historical review of the studies on realistic effective interactions in nuclei is presented. The merits and demerits of the shell model (SM) are discussed. The effect of the choice of configuration space on the nature of the effective interactions in closed shells and the application of perturbation theory for calculations are discussed. A comparison is made of the Preedom-Wildenthal (PW) interactions, and the Chung-Wildenthal (CW) interactions with the modifi-

cation of Two-Body Matrix Elements (TBME) to get the best fit. The effect of spin-orbit force on the Kuo-Brown has been studied for some nuclei and the TBME effective interactions. The interaction components in relative states are examined. Results are discussed.

1634 **Unitary pole approximation.** Mathur, V.S. (Banaras Hindu Univ. (India). Dept. of Physics). pp 383-397 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21A. Invited talks. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

It is well known that a considerable simplification results in 3-body equations (in the sense that the dimensionality of the coupled integral equations is reduced), if the input two-body t-matrix is either of a separable form or is a sum of separable terms. Of the one-term separable approximations to the t-matrix, the Unitary Pole Approximation (UPA), the physical basis of the UPA and its connection with the Unitary Pole Expansion (UPE) is reviewed and its effectiveness in the 3-body bound state calculations, implying thereby its validity for negative energies is discussed. The similarity in the forms of Mitra's 3-body equations using a separable potentials and those obtained from Faddeev-Eyges equations using the UPA are traced to the mathematical equivalence of the two approaches. On the basis of a couple of test calculations it is observed that UPA is good even at positive energies. The observation seems to have a considerable relevance to the problem of the off-shell continuation of the t-matrix when the bound state is delineated.

1635 (IPNO-TH—80-49, pp 1-25) **Unitarity constraints in the construction of 'optical potential' operators.** Dedonder, J.P. [nd]. (In French). Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

Unitarity constraints are used to build optical potential operators accounting for dynamical complexities (residual interaction in the nuclear description, projectile rescattering). The introduction of elementary three-body transition operators in addition to the two-body operators present in a first order theory, allows an explicit construction of a second order optical potential operator. Such a theory, unitarity within the subspace including the ground state and the one particle-one hole and two particle-two hole configurations, leads to a realistic description of one particle-one hole excitations which was not the case of the first order theory.

1636 (IPNO-TH—80-49, pp 1-19) **Inner shells in heavy nuclei.** Gales, S. [nd]. (In French). Dep. NTIS (US Sales Only).

From 9. meeting of the theoretical physics department; Aussois, France (17 Mar 1980).

One hole state in orbits well below the Fermi surface have been observed using the selectivity of the ($^3$He,$\alpha$) pick-up reactions. The fragmentation of the neutron-hole strength as well as the spreading of such simple mode of excitation into more complex states are compared to recent calculations within the quasiparticle-phonon or the single particle vibration models. We report on recent measurement of the spin J for inner-hole states in heavy nuclei using the analyzing power of the (p,d) reaction. Large enhancement of cross sections have been observed in the study (p,t) reactions on Zr, Sn and Sm isotopes at high excitation energy. The origin of such concentration of two neutron hole strength will be discussed.

1637 (OUP—81-09, pp 46-49) **Alternative formulation of the particle-rotor model.** Engeland, T. [nd]. Dep. NTIS (US Sales Only).

In Nuclear physics group report, January 1 to December 31, 1980.

## 6540 Radiation And Shielding Physics

*REFER ALSO TO CITATION(S) 415, 441*

1638 (EUR—6813(Vol.2), pp 732-742) **Few-channel unfolding in shielding - the SENSAK code.** McCracken, A.K. (UKAEA Atomic Energy Establishment, Winfrith). 1980. Dep. NTIS (US Sales Only).

From 3. ASTM-EURATOM symposium on reactor dosimetry; Ispra, Italy (1 Oct 1979).

Information available for the unfolding of flux spectra from detector counting-rates include some knowledge of the nature of the spectrum sought. In reactor work -and particularly in shielding- we shall usually have some calculation which, even using the best available methods, may be subject to quite large uncertainties. Some tests with a prototype code SENSAK I using the above type of spectral information were carried out using numerical minimisation subroutines to derive unfolding spectra, and work on the estimation of uncertainties on the output spectrum by introducing Monte Carlo sampling of the probability density functions (p.d.f's) of the measured parameters was initiated.

1639 **Theoretical investigations of deviations from statistical equilibrium in planar channeling.** Gaonkar, S.G.; Wagh, A.G. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). pp 740-742 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

The effect of deviations from statistical equilibrium in planar channeling on the planar scan of impurity yield has been theoretically investigated. The computer program determines, at several depths in the crystal, the overlap between the impurity occupancy and ion trajectories in a static continuum potential. The impurity thermal vibrations are represented by a gaussian impurity distribution about a mean displacement from lattice planes. The overlap summed over all trajectories with a given incident angle is treated as a measure of the close interaction yield from impurity atoms. The 2 MeV $He^+$ (110) dip for substitutional impurities in Si so calculated exhibits a strong dependence on the impurity depth even upto depths of 1000A. This is attributed to the large oscillations in impurity yield with depth for a fixed incident angle. Similar effect has been obtained for several incident energies and planar channels and with other impurity sites. The implications of these results in planar channeling experiments for impurity lattice location are discussed.

1640 (KFTI—79-57, pp 44-47) **Relativistic electron radiation in diamond monocrystal.** Bochek, G.L.; Vit'ko, V.I.; Gorbenko, V.G.; Grishaev, I.A.; Zhebrovskii, Yu.V.; Kovalenko, G.D.; Kolesnikov, L.Ya.; Kulibaba, V.I.; Rubashkin, A.L.; Shramenko, B.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

In Physical experiment technique.

Using full absorption $\gamma$-spectrometer constructed on the basis of CsI (Tl) monocrystal radiation spectra of electrons with the energy $E_0 = 1.2$ GeV have been measured in the diamond monocrystal of 300 $\mu$m thick. It is shown that in the Esub($\gamma$) $<$ 0.1 Esub(0) spectrum region radiation of electrons moving parallel to the [110] axis or to the (110) plane considerably exceeds radiation from the disoriented crystal. Comparison of experimental spectra with the calculation of coherent bremsstrahlung in the Born approximation shows qualitative agreement, although in the experiment the intensity is lower than that predicted by the theory.

1641 (KFTI—79-65, pp 10-15) **Foundations of the imitation theory of reactor damages of materials using heavy ion accelerators.** Gann, V.V.; Rozhkov, V.V.; Yudin, O.V. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. All-union school on radiation damage physics; Alushta, Ukrainian SSR (23 Sep - 4 Oct 1979).

A problem of correlation of the effect of neutron and ion irradiations on materials is considered. It is suggested to use the probability density of defects formation by a primarily knocked-on atom (PKA) with energy T as a convenient comparison characteristic of material damageability. Basing on the function a simple criterion of correspondence for different types of irradiation is intro-

duced. The spectral function is introduced which characterizes the contribution of PKA at T to the radiation-induced change in the material particular property. Employment of this function allowed the construction of a more general correspondence criterion for different types of irradiation, which takes account of the effect of the PKA spectrum shape on the change of a given property.

1642 **Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding.** Paris, France; OECD (1981). vp. (CONF-8010113—).

From Specialists meeting on nuclear data and benchmarks for reactor shielding; Paris, France (27 Oct 1980).

Separate abstracts are presented for each of the conference papers included in the data base.

1643 **Internal and external bremsstrahlung spectra in thick lead and aluminium targets excited by soft beta rays.** Ahmad, S.; Powar, M.S.; Singh, M. (Punjabi Univ., Patiala (India). Dept. of Physics). pp 197-198 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21B. Nuclear physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

1644 **Channeling in thin lead sulphide films.** Wagh, A.G. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). pp 746 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

1645 **Simplification of calculation algorithm for γ-spectra processing.** Klimov, A.N. pp 300-304 of Prikladnaya yadernaya spektroskopiya. T. 8. Moscow, USSR; Atomizdat (1978). (In Russian)

From 27. all-union conference on nuclear spectroscopy and nuclear structure; Tashkent, USSR (22 Mar 1977).

The operation is considered for simplifying calculations when processing isolated peaks of γ spectra described by the three-parametric Gauss dependence. The idea of simplifying the usual processing procedure with the aid of a set of normal equations consists in the following. If the dissection intervals of coordinate X are similar, all the sums in the left parts of the set of normal equations may be replaced by integrals. The conditions for applying this procedure are as follows: the number of points in which the measurements are performed must be at least 6-7, i.e. the semiwidth parameter of the Gauss peak $b>=1$; the points, in which the measurements are performed, mus occupy a range that is symmetric in relation to the γ-peak and it would be at least +-2.5 V. The calculation results are given for three series of measurements obtained by means of classical and simplified procedures. The use of the simplified method permitted to reduce significantly the content of programs for processing isolated γ peaks.

## 6550 Medical Physics

*REFER ALSO TO CITATION(S) 919, 1188*

## 6560 Solid State Physics

1646 (INIS-mf—6084, pp vp) **Percolation processes.** Kunz, H. (Ecole Polytechnique Federale, Lausanne (Switzerland)). 1980. Dep. NTIS (US Sales Only).

From Conference on the recent advances in statistical mechanics; Poiana Brasov, Romania (30 Aug 1979).

Percolation is a unifying which appeared to be rather useful in trying to understand some properties of disordered physical systems, or some phase transitions in polymers, like gelation or vulcanisation. Although implicitely used in the pioneering work of Flory in 1941 on the sol-gel transition of polymers, it was first introduced in a well-defined way by the mathematicians Hammersley and Broadbent in 1957, who obtained the first rigorous result. Since then, the subject has seen a variety of new applications and its recent study has largely benefited from the vigorous development of critical phenomena after the introduction of the RG ideas and techniques.

1647 (INIS-mf—6084, pp vp) **Equation of state of one component Coulomb systems.** Choquard, P. (Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland)). 1980. Dep. NTIS (US Sales Only).

From Conference on the recent advances in statistical mechanics; Poiana Brasov, Romania (30 Aug 1979).

We consider here the model, introduced by E. Wigner in 1938, of an assembly of point charges immersed in an homogenous neutralizing background. We recall that if the particles are electrons with spin 1/2 the model is generally called jellium and if the particles are classical ions, it is called one-component plasma (O.C.P). Both interpretations of the Wigner model have given rise to extensive numerical, heuristic and rigorous investigations in the last two decades (on the jellium as a model of simple metals and on the O.C.P. as a model of fully ionized matter). However, the fact that, until recently, most of the many-body theoretical investigations and of the numerical simulations (particularly in 3 D.) have been carried out on systems subject to periodic boundary conditions, has made it impossible to reveal the features which are presented here. Rigorous results concerning the problems dealt with in these notes have just been announced.

1648 (INIS-mf—6084, pp vp) **Coupling to a secondary order parameter near the commensurate-incommensurate transition.** Trimper, S. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). 1980. Dep. NTIS (US Sales Only).

From Conference on the recent advances in statistical mechanics; Poiana Brasov, Romania (30 Aug 1979).

The incommensurate phase is characterized by the formation of phase solitons. The influence of the coupling to elastic degrees of freedom and to the polarization is considered. The displacement field and the polarization reveal also a highly nonhomogeneous soliton-like behaviour. The transition can be continuous or of first order depending on the solution of the corresponding equation. The long range character of the elastic degrees of freedom reflects itself in the occurence of a nonlocal effective interaction. The influence of the temperature is also investigated.

1649 (INIS-mf—6449, pp vp) **Problems of charged particle channeling in monocrystals.** Wedell, R. (Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik). 1980. (In German). Dep. NTIS (US Sales Only).

From 7. meeting physics and electronics; Berlin, German Democratic Republic (11 Feb 1980).

Theoretical problems of channeling protons and alpha particles at low penetration depths, range determination of xenon ions in copper monocrystals, and formation mechanisms of spontaneous electromagnetic radiation by channeling relativistic electrons and positrons are considered. An agreement with experimental results was found for the three effects described.

1650 **Dynamic theory of phase transition in hydrogen bonded ferroelectric crystals : Transverse susceptibility.** Ganguli, S.; Nath, D.; Chaudhuri, B.K. (Indian Association for the Cultivation of Science, Calcutta. Dept. of Magnetism). pp 749-754 of Current trends in lattice dynamics : Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

Using double time temperature dependent Green's function technique the transverse dielectric constants of $KH_2PO_4$ (KDP) and $KH_2AsO_4$ are calculated with pseudo-spin-lattice coupled mode model. From the analysis of the present theoretical and other experimental results it is concluded that: (i) the Green's function is related to the fluctuation of transverse susceptibility (chisub(Q)) indicating that the transverse and longitudinal (along C-axis) polarizations are simultaneously induced by the proton displacements along the hydrogen bonds, (ii) a "Pseudosoft" mode behaviour is found to

give rise to the Cusp-like singularity of the chisub(Q) vs. T curves of KDP and KDA, (iii) it appears to have two transition temperatures (one associated with chisub(a) and the other with chisub(c)) since the "pseudosoft" mode and the 'actual' soft mode do not freeze at the same temperature Tsub(c) and (iv) the antiferroelectric type of dipole ordering previously considered by Havlin, Litov and Uehling is not the only way to explain the transverse susceptibility of KDP type crystals as is evidenced from the very good fitting of the experimental results with the theory and the model parameters calculated are also in very good agreement with Raman spectroscopic results. For the calculation of transverse susceptibility along a - or b - axis, the well known double time temperature dependent Green's function technique has been used. An expression for the Hamiltonian containing pseudo-spin (PS) interaction has been given.

1651 (KFTI—79-65, pp 21-26) **Instability zones of interacting point defects in the periodical structures.** Koshkin, V.M.; Zabrodskii, Yu.R.; Podorozhanskaya, N.M. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Monokristallov, Stsintilyatsionnykh Materialov i Osobo Chistykh Veshestv, Kharkov (Ukrainian SSR)). 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. All-union school on radiation damage physics; Alushta, Ukrainian SSR (23 Sep - 4 Oct 1979).

A dependence of the size of the instability zone on the type and basic constants of the defects interaction potential, migration energy and other crystal constants is considered. The calculated sizes of instability zones for semiconductor, ion and metal crystals are in good agreement with experimental values available in the literature. A case of simultaneous action of the Coulomb and elastic potentials and associated appearance of a barrier between two interacting point defects are considered as well.

1652 **Phonon modes in a disordered lattice.** Chakrabarti, B.K.; Roy, G.K.; Sinha, S.K. (Saha Inst. of Nuclear Physics, Calcutta (India)). pp 696-704 of Current trends in lattice dynamics: Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay, India; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

A simple cubic lattice, in which a small fraction of sites are replaced at random by atoms of a different kind and the resulting vibrational excitations are studied. Both the mass and force constant disorders are considered. The equation of motion of the Green function is developed following Matsubara and Yonezawa neglecting shear modes; the resulting expression for dispersion relation is summed up following Keneyashi and Jones to the lowest order in concentration. The results are obtained analytically and are found to be exact up to the linear term in concentration. Expressions have been obtained for the renormalised energies and the damping of the long wavelength phonon modes. In the special case of simple disorder, the results are compared with those of Langer.

1653 **Two-phonon bound states in imperfect crystals.** Behera, S.N.; Samsur, S.K. (Institute of Physics, Bhubaneswar (India)). pp 755-761 of Current trends in lattice dynamics : Proceedings of the seminar [held at] Bombay, December 26-27, 1978. Rao, K.R. (ed.) (Bhabha Atomic Research Centre, Bombay (India)). Bombay; Indian Physics Association (1979).

From Seminar on current trends in lattice dynamics; Bombay, India (26 Dec 1978).

The bound state calculations have been extended to an imperfect crystal. In this procedure, the imperfection is a single (or very low concentration of) substitutional impurity atom(s) characterized by mass change (lambda) parameters executing anharmonic vibrations. The anharmonicity is characterized by only a quartic term. A Green's function calculation has been performed following the procedure adopted by Pathak and Jindal. Further, simplifying assumptions are made to obtain a solution for the two particle Green's function equations of the imperfect crystal. The host crystal phonon spectrum is described by the Einstein model in order to calculate the two phonon states. The results obtained are : (i) In the limit of the impurity parameters going to zero, the perfect crystal result of Pathak and Jindal is recovered. The Einstein model analysis predicts the existence of a bound state for all strengths of the quartic anharmonic coupling parameter (delta) and its frequency is expressed as a function of $\omega$ and eta, in which $\omega > 2\omega$sub(0) for eta>0. (ii) For an imperfect crystal a two phonon bound state is seen to exist even in the absence of anharmonicity. Such a bound state is mediated by the impurity and its frequency is expressed as a function of $\omega$, lambda and tau where lambda = (Msub(I)-M)/Msub(I) and tau = (phi - phisub(0))/phisub(0). Again for the solution corresponding to the upper sign, $\omega > 2\omega_0$ as is expected for a bound state and (iii) Finally, a general bound state solution is seen to exist resulting from the effects of both the anharmonicity and the imperfection. It is urged that such bound states should be looked for in the Raman spectrum of imperfect crystals.

## 6561 Superconductivity

1654 **Electrical resistivity of I indium sulphides (InS) crystals down to 4.2deg K and upto 80 kilobar.** Bandyopadhyay, A.K.; Oza, A.K.T.; Madhava, M.R.; Bhat, R.L.; Srinivasan, R.; Gopal, E.S.R. (Indian Inst. of Science, Bangalore. Dept. of Physics). pp 1-3 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

The electrical resistivity of InS crystals grown from melt has been studied down to 4.2deg K using a Leybold-Heraeus continuous flow cryostat. The normalized resistance does not change very much with temperature. This behaviour is characteristic of a degenerate semiconductor. Four probe high pressure resistivity measurements upto 80 K bar have been performed in a Bridgman anvil apparatus. The normalized resistance remains more or less constant upto 15 K bar beyond which there is a steep increase. This behaviour is also discussed.

1655 **Superconductivity in scandium-zirconium systems.** Auluck, S.; Singh, G.S. (Roorkee Univ. (India). Dept. of Physics). pp 4-5 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

1656 **Hotspot induced anomalies and hysteresis in long superconducting Ag-Sn proximity-effect bridges.** Dharmadurai, G. (Bhabha Atomic Research Centre, Bombay (India)); Ratnam, B.A. (Tata Inst. of Fundamental Research, Bombay (India)). pp 9-12 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

The current-voltage (I-V) characteristics of long Ag-Sn proximity effect bridges (with and without protruding normal metal strips, which act as extra cooling fins) have been investigated at both temperatures close to the lambda point of $^4$He where a sudden improvement of heat removal occurs. An anomolous kink in the bridge voltage at a well defined and reproducible bridge current in the voltage sustaining states has been observed. It is found to disappear when the bridge is immersed in superfluid helium. A sudden jump in the critical current hysteresis at the lambda point is also observed. The above observations appear to be well accounted for on the basis of a Skocpol, Beasley and Tinkham (SBT) hotspot model suggesting that their origins are thermal.

1657 **Phonon-injection-induced nonequilibrium phenomena in superconducting proximity-effect bridges.** Dharmadurai, G. (Bhabha Atomic Research Centre, Bombay (India)); Ratnam, B.A. (Tata Inst. of Fundamental Research, Bombay (India)). pp 13-15 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

Extensive investigations of the current-voltage characteristics of long Ag-Sn proximity-effect bridges when phonons are dc injected from heated transverse normal metal strips show that at bath temperatures above Tsub(lambda) (the lambda point of $^4$He) the experimentally observed critical current dependence on in ector current deviates from a simple heating model in a direction consistent with Parker's modified heating theory of nonequilibrium superconductors whereas below Tsub(lambda) the deviation changes direction. However, the injection induced transition is continuous. Further below Tsub(lambda), bridges underlaid with a thin film of germanium exhibit a first-order transition to the normal state which is consistent with the Owen-Scalapino model for nonequilibrium superconductors. Possible implications are discussed.

1658 **Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V.** Ray Chaudhury, M.; Chatterjee, P.; Chatterjee, S. (Indian Association for Cultivation of Science, Calcutta). pp 16-18 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

Theoretical calculations of electron-phonon coupling constant lambda for tha A15 compounds $Nb_3Al$, $Nb_3Sn$, $V_3Si$ and $V_3Ge$ with the help of McMillan's theory in conjunction with the theory of Gaspari and Gyorffy are reported. The Herman-Skillman atomic potentials with full Slater exchange are used for calculating the phase shift of the potentials from the multiple.scattering theory; while the density of states and the Fermi energy were taken from the APW band structure calculations of Matheiss. Using these values of lambda, the Tsub(c)'s (critical temperatures) of these materials are obtained. These agree fairly well with experiments. Since, for the highest Tsub(c) material, $Nb_3Ge$, no band structure calculation exists, Tsub(c) is plotted as a function of the Fermi energy. From the plot the experimental Tsub(c) of 23.2deg K is obtained for Esub(F) = 1.525 Ryd.

1659 **Characteristics of superconducting solenoid with detachable current leads.** Chopra, V.; Dharmadurai, G.; Satya Murthy, N.S. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). pp 821-823 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

The design and characteristics of two superconducting solenoids capable of producing fields upto 2.7 T and 5.0 Tesla respectively are described, and compared with the short sample characteristics of the materials. The training effect in the magnets are compared and the behaviour of one of the magnets in the persistent mode is studied. Both the magnets have been charged satisfactorily through novel detachable leads, design features of which are reported here.

1660 **Design and fabrication of a high homogeneity high field superconducting magnet, a metal cryostat and a high stability energiser.** Bhide, V.G.; Ekbote, S.N.; Gupta, A.K.; Narlikar, A.V.; Sharma, R.G.; Yadav, V.S. (National Physical Lab., New Delhi (India); Swaminathan, G.S.; Vaidyanathan, C.S. (Bharat Heavy Electricals Ltd., Hyderabad (India). pp 824-827 of Proceedings of the nuclear physics and solid state physics symposium [held at] Bombay, December 28-31, 1978. Vol. 21C. Solid state physics. Bombay, India; Department of Atomic Energy (1979).

From Nuclear physics and solid state physics symposium; Bombay, India (28 Dec 1978).

Design, fabrication and testing of a superconducting magnet system consisting of a superconducting magnet, a liquid helium metal cryostat and a high stability high current-low voltage energizer, was recently completed at NPL. The magnet has a clear bore of 38 mm and a central field of 65 k Gauss at 60 A with a homogeneity approaching 0.01% over a cm dsv. The metal cryostat is fabricated using AISI 321 stainless steel and has a liquid helium evaporation rate of 0.2 l/hr when it is half filled. The energizer has a rating of 0-80A, and 0-8V, the current stability being a few parts in $10^4$. It is equipped with the trip circuits for switching off the output at any accidental onset of resistance in the superconducting magnet, and to limit the reverse voltage on an unexpected power failure.

## 6570 Theoretical Physics

*REFER ALSO TO CITATION(S) 1397*

1661 (INIS-mf—6479, pp vp) **Non-statical sources of the Taub and Kasner solutions of Einstein equations.** Horsky, J.; Lorenc, P.; Novotny, J. (Universita J.E. Purkyne, Brno (Czechoslovakia). Prirodovedecka Fakulta). 1978. (In Czech). Dep. NTIS (US Sales Only).

From 5. conference of Czechoslovak physicists; Kosice, Czechoslovakia (29 Aug 1977).

1662 **Tensor function approach to constitutive equations of inelasticity.** Murakami, S. (Nagoya Univ. (Japan). Dept. of Mechanical Engineering). pp L1/4 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Though various theories for elaborated engineering constitutive models have been proposed so far to improve the description of inelastic response of engineering materials, most of them have been formulated within the framework of the classical theories of plasticity and creep. In these cases, the expressions of flow potentials and hardening rules are usually modified a priori by adding some additional terms, and the related material constants are determined by experiments. The difficulties of such approaches consist in the lack of generality and pertinence, besides that they are considerably laborious. In the field of non-linear continuum mechanics, on the other hand, there has been a continuos development of more powerful approaches which are applicable to these problems. It is the aim of the present paper to show the utility of the tensor function approach to the development of the non-classical constitutive equations of inelasticity and to elucidate the practical procedures and some new results of it.

1663 **Order, heat, intrinsic dissipation and inelastic analysis.** Boisserie, J.M. (Electricite de France, 78 - Chatou. Service Informatique et Mathematiques Appliquees); Guelin, P. (Grenoble-1 Univ., 38 (France). Inst. de Mecanique). pp L1/6 (1-10) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In French)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper is devoted to the analysis of the physical background of a discrete memory definition, previously used in a tensorial formulation of constitutive laws describing hysteresis and hardening.

1664 **Nonlinear endochronic theory of cylic plastic hardening and softening.** Kosinski, W.; Nashiro, T. (Polska Akademia Nauk, Warsaw. Inst. Podstawowych Problemow Techniki). pp L2/6 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Using the internal state variable approach a nonlinear finite endochronic theory of plasticity consisted of a nonlinear finite constitutive equation, a nonlinear evolution equation, and an intrinsic time equation is constructed and applied to problems of cyclic plasticity.

1665 **Mathematical programming methods in engineering plasticity.** Maier, G. (Politecnico di Milano (Italy)); Munro, J. (Imperial Coll. of Science and Technology, London (UK). Dept. of Civil Engineering). pp L3/1 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Since the early fifties when problems of plastic limit analysis were first recognized as linear programs, the applications of mathematical programming methods to structural mechanics have grown continuously. This lecture will briefly outline some of the main concepts of MP which are believed to be essential for such applications and will illustrate them through a set of selected problems and specific examples which have mostly appeared recently in the technical literature and are likely to be of interest in nuclear technology-oriented structural mechanics.

1666 **Sheakedown analysis by displacement method and equilibrium finite element.** Nguyen Dang, H. (Liege Univ. (Belgium). Lab. de Mecanique des Materiaux et de Statique des Constructions); Palgen, L. (Fonds National de la Recherche Scientifique, Brussels (Belgium)). pp L3/3 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In the present finite element formulation the shakedown analysis is reduced to a simple case of non-linear programming problem.

1667 **Local bounds on dissipation energy in shakedown theory.** Polizzotto, C.; Mazzarella, C.; Pnazeca, T. (Palermo Univ. (Italy). Facolta di Architettura). pp L3/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The paper deals with elastic-workhardening discrete structures subjected to quasi-static loads and/or imposed strains, which vary in an arbitrary manner but remain always within a given domain. In particular, it gives a method able to provide bounds on plastic dissipation energy which is performed within any part of the structure during the unknown real loading history. Such a bound has the character of being optimal (the most stringent within a class of bounds) as well as of being local (the bounding quantity is referred to the same part of the structure, which the bounded plastic work is referred to). The procedure adopted uses a perturbation technique which inables us to formulate two different, but equivalent problems whose solutions, if any, furnish bounds on plastic work: (a) a boundary value problem which can be viewed as the holonomic description of the original shakedown problem suitably perturbed, and (b) a convex minimization problem which characterizes the above boundary value problem and which directly performs the bound optimization. Computational aspects are not considered. A simple example concludes the paper.

1668 **Shakedown analysis by finite element incremental procedures.** Borkowski, A.; Kleiber, M. (Polska Akademia Nauk, Warsaw. Inst. Podstawowych Problemow Techniki). pp L6/6 of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

It is a common occurence in many practical problems that external loads are variable and the exact time-dependent history of loading is unknown. Instead of it load is characterized by a given loading domain: a convex polyhedron in the n-dimensional space of load parameters. The problem is then to check whether a structure shakes down, i.e. responds elastically after a few elasto-plastic cycles, or not to a variable loading as defined above. Such check can be performed by an incremental procedure. One should reproduce incrementally a simple cyclic process which consists of proportional load paths that connect the origin of the load space with the corners of the loading domain. It was proved that if a structure shakes down to such loading history then it is able to adopt itself to an arbitrary load path contained in the loading domain. The main advantage of such approach is the possibility to use existing incremental finite-element computer codes.

1669 **Plastic frames: Reduction of the kinematical inequality and optimization.** Brousse, P. (Paris-6 Univ., 75 (France). Dept. de Mecanique). pp L10/7 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. L. Materials modeling and inelastic analysis of metal structures. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979). (In French)

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

It is well-known that the following inequality plays an essential part in the theory of perfectly plastic frames: for all kinematically admissible mechanisms and for bending moments associated with the hinge rotations by the flow rule, the plastic dissipation power is greater than or equal to the load power. This inequality will be termed as the kinematic inequality. It contains parameters generating the mechanisms. In simple cases, several ingenious authors obtained appreciable results excluding parameters. But, in more complicated cases, for instance when the given quantities are not numerical, the parameters remain in the kinematic inequality, thereby precluding exploitation of the kinematic approach. In the present work we overcome this dificulty: we reduce the kinematic inequality, i.e., we replace it by inequalities containing no variable parameter; we then state a process giving automatically such inequalities; finally, we treat a practical application.

## 6580 Mathematical Physics

1670 **Some applications of polynomial and spline approximation.** Collatz, L. pp 1-15 of Polynomial and spline approximation. Theory and applications. Sahney, B.N. (ed.). Dordrecht, Netherlands; Reidel (1979).

From NATO Advanced Study Institute; Calgary, Canada (26 Aug 1978).

The distinction is described between qualitative error estimations (order of magnitude of the error) and quantitative error bounds (numerically computable strong mathematical pointwise error bounds). Progress by using approximation methods is made in the last years in singular nonlinear boundary value problems, in the method of finite elements, in free boundary value problems (exact inclusion for the free boundary in simple cases) and other areas.

1671 **Polynomial and spline approximation. Theory and applications.** Sahney, B.N. (ed.). Dordrecht, Netherlands; Reidel (1979). vp. (CONF-7808134—).

From NATO Advanced Study Institute; Calgary, Canada (26 Aug 1978).

Individual items from the study institute were prepared separately for the data base. (GHT)

# 70 FUSION ENERGY

## 7001 Plasma Research

1672 (INIS-mf—6424, pp vp) **Parametric amplification of Alfven waves.** Collins, G.A. (Sydney Univ. (Australia). Dept. of Plasma Physics). 1981. Dep. NTIS (US Sales Only).

From 13. AINSE plasma physics conference; Lucas Heights, Australia (9 Feb 1981).

1673 (INIS-mf—6424, pp vp) **Relativistic effects in cyclotron instabilities.** Melrose, D.B.; Hewitt, R.G. (Sydney Univ. (Australia). Dept. of Theoretical Physics). 1981. Dep. NTIS (US Sales Only).

From 13. AINSE plasma physics conference; Lucas Heights, Australia (9 Feb 1981).

1674 (INIS-mf—6424, pp vp) **X-ray laser gain measurements in laser produced plasmas.** Tallents, G.J. (Australian National Univ., Canberra. Dept. of Engineering Physics). 1981. Dep. NTIS (US Sales Only).

From 13. AINSE plasma physics conference; Lucas Heights, Australia (9 Feb 1981).

1675 **Lower hybrid heating in the Alcator A tokamak.** Schuss, J.J.; Porkolab, M.; Takase, Y. (Massachusetts Inst. of Tech., Cambridge (USA). Francis Bitter National Magnet Lab.) (and others). *Nuclear Fusion;* **21**: No. 4, 427-452(Apr 1981).

The results and interpretation of the modest-power (approximately 90 kW) lower-hybrid-heating experiment on Alcator A are presented. The expected results from linear waveguide-plasma coupling theory are outlined, and the possible effects of parametric instabilities, scattering from density fluctuations, and imperfect energetic ion confinement are addressed. It is found experimentally that good coupling and the absence of RF breakdown are achieved with a double waveguide array at available RF power densities Psub(RF)< =4.5 kW.cm$^{-2}$, the waveguide vacuum windows being outside the toroidal field magnets; a waveguide array having vacuum windows near the waveguide mouth so that the $\omega = \omega$sub(ce) layer can be pressurized shows no breakdown at Psub(RF)>8 kW/cm$^2$ when a single waveguide is energized. Energetic ion production and a factor-of-50 increase in the fusion neutron rate are observed to take place at well defined values of central plasma density; below these densities electron heating occurs. The ion tail production is found to be independent of the relative phase of the double waveguide array employed. Probes at the plasma edge observe a frequency-down-shifted and broadened RF pump signal that is strongly attenuated as the plasma density increases through the neutron production band. The neutron rate decay times imply that the RF creates ion tails having a substantial fraction of their energy above 50 keV. The neutron decay times and rates strongly depend on plasma current and indicate the expected influence of ion confinement on RF heating efficiencies. Finally, the RF heating efficiencies are assessed.

## 7002 Fusion Power Plant Technology

*REFER ALSO TO CITATION(S) 679*

1676 **Advanced lasers for fusion.** Krupke, W.F.; George, E.V.; Haas, R.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 627-752 of Laser handbook. Volume 3. Stitch, M.L. (ed.) (Exxon Nuclear Co., Inc., Richland, WA (USA)). Amsterdam, Netherlands; North-Holland (1979).

Laser drive systems' performance requirements for fusion reactors are developed following a review of the principles of inertial confinement fusion and of the technical status of fusion research lasers (Nd:glass; $CO_2$, iodine). These requirements are analyzed in the context of energy-storing laser media with respect to laser systems design issues: optical damage and breakdown, medium excitation, parasitics and superfluorescence depumping, energy extraction physics, medium optical quality, and gas flow. Three types of energy-storing laser media of potential utility are identified and singled out for detailed review: (1) Group VI atomic lasers, (2) rare earth solid state hybrid lasers, and (3) rare earth molecular vapor lasers. The use of highly-radiative laser media, particularly the rare-gas monohalide excimers, are discussed in the context of short pulse fusion applications. The concept of backward wave Raman pulse compression is considered as an attractive technique for this purpose. The basic physics and device parameters of these four laser systems are reviewed and conceptual designs for high energy laser systems are presented. Preliminary estimates for systems efficiencies are given.

1677 **Considerations on the approach to ignition in large tokamaks.** Watkins, M.L.; Stringer, T.E.; Gibson, A.; Core, W.G.F. (JET Joint Undertaking, Abingdon, UK); Robertson, I.L.; Cordey, J.G.; Field, J.J. (Euratom/UKAEA Fusion Association, Abingdon (UK). Culham Lab.). pp 639-650 of Plasma physics and controlled nuclear fusion research 1980. Vol. 1. Proceedings of the eighth international conference held by the IAEA in Brussels, 1-10 July 1980. Vienna, Austria; IAEA (1981).

From 8. international conference on plasma physics and controlled nuclear fusion research; Brussels, Belgium (1 Jul 1980).

The approach to ignition in one-dimensional tokamak models is examined, first by mapping parameter space using a steady-state code and then by applying, to JET, a particular transport model justified by comparison with PLT. The appearance of a cool plasma mantle to limit impurity production is an important feature of this model and conditions are given for the mantle to exist stably.

1678 **Experimental results from the DITE bundle divertor.** Erents, S.K.; Fielding, S.J.; Gill, R.D. (Euratom/UKAEA Fusion Association, Abingdon (UK). Culham Lab.). pp 697-703 of Plasma physics and controlled nuclear fusion research 1980. Vol. 1. Proceedings of the eighth international conference held by the IAEA in Brussels, 1-10 July 1980. Vienna, Austria; IAEA (1981).

From 8. international conference on plasma physics and controlled nuclear fusion research; Brussels, Belgium (1 Jul 1980).

The DITE bundle divertor is used to study impurity control, with I/sub p/< = 60 kA and anti n/sub e/< = 1.5 x $10^{19}$m$^{-3}$. Impurity injection experiments measure the divertor screening efficiency, xi/sub s/ approximately 0.4. Density decay and ion saturation flux measurements provide the divertor particle exhaust efficiency, xi/sub x/ approximately 0.3. Energy balances are obtained, and the power exhaust efficiency xi/sub p/ approximately 0.15. The variation of these parameters with density is discussed. The combined effect of these divertor functions on impurity fluxes is described, and the results compared with a global model of recycling. Preliminary extensions of this work include neutral-beam heating and operation at I/sub p/ approximately 90 kA with anti n/sub e/ approximately 2.4 x $10^{19}$m$^{-3}$.

1679 **Calculation model and design principles of the demonstration Tokamak-reactor vacuum system.** Mazul, I.V.; Saksagansky, G.L.; Serebrennikov, D.V. (D.V. Efremov Scientific Research Institute of Electrophysical Apparatus, Leningrad (USSR)). pp 110-114 of Proceedings of the eighth international vacuum congress. Vol. 2. Vacuum technology and vacuum metallurgy. Langeron, J.P.; Maurice, L. (eds.). Paris, France; Societe Francaise du Vide (1980).

From 8. international vacuum congress/ 4. international conference on surface science and 3. European conference on solid surface; Cannes, France (22 Sep 1980).

A calculation model is proposed, design principles are formulated as well as basic parameters are given of the demonstration tokamak-reactor vacuum system. The functional and structural arrangement schemes are considered. A comparative qualitative analysis is made of various concepts of the first wall-as one of the most important vacuum channel elements - from the standpoint of consruction technology and operation. The relations between the structure and geometry parameters and vacuum ones in the divertor and non-divertor cases are determined from the equation of the balance of charged and neutral particle flows in the 'plasma-wall-pump' system. A necessity is emphasized of formulating the criteria of the choice of these parameters in particular, helium accumulation kinetics-based upon the plasma characteristics of the reactor. A survey is presented of the physics and technology characteristics of high vacuum D-T and He pumping means, including surface-action pumps and compression pumps, and assessments are given of their potential appropriateness for the reactors of the nearest future. The Soviet conceptual project of the vacuum system of the INTOR is briefly described.

1680 **Experimental study of gaseous lithium deuterides and lithium oxides. Implications for the use of lithium and $Li_2O$ as breeding materials in fusion reactor blankets.** Ihle, H.R.; Wu, C.H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nuklearchemie); Kudo, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). pp 31-44 of Thermodynamics of nuclear materials 1979. Vol. 2. Proceedings of an international symposium held by the IAEA in Juelich, Federal Republic of Germany, from 29 January to 2 February 1979. Vienna, Austria; IAEA (1980).

From International symposium on thermodynamics of nuclear materials; Julich, F.R. Germany (29 Jan 1979).

In addition to LiH, which has been studied extensively by optical spectroscopy, the existence of a number of other stable lithium hydrides has been predicted theoretically. By analysis of the saturated vapour over dilute solutions of the hydrogen isotopes in lithium, using Knudsen effusion mass spectrometry, all lithium hydrides predicted to be stable were found. Solutions of deuterium in lithium were used predominantly because of practical advantages for mass spectrometric measurements. The heats of dissociation of LiD, $Li_2D$, $LiD_2$ and $Li_2D_2$, and the binding energies of their singly charged positive ions were determined, and the constants of the gas/liquid equilibria were calculated. The existence of these lithium deuterides in the gas phase over solutions of deuterium in lithium leads to enrichment of deuterium in the gas above 1240 K. The enrichment factor, which increases exponentially with temperature and is independent of concentration for low concentrations of deuterium in the liquid, was determined by Rayleigh distillation experiments. It was found that it is thermodynamically possible to separate deuterium from lithium by distillation. One of the alternatives to the use of lithium in (D,T)-fusion reactors as tritium-breeding blanket material is to employ solid lithium oxide. This has a high melting point, a high lithium density and still favourable tritium-breeding properties. Because of its rather high volatility, an experimental study of the vaporization of $Li_2O$ was undertaken by mass spectrometry. It vaporizes to give lithium and oxygen, and LiO, $Li_2O$, $Li_3O$ and $Li_2O_2$. The molecule $Li_3O$ was found as a new species. Heats of dissociation, binding energies of the various ions and the constants of the gas/solid equilibria were determined. The effect of using different materials for the Knudsen cells and the relative thermal stabilities of lithium-aluminium oxides were also studied.

1681 **Applications of metallic composites in the magnet system of a demonstration fusion reactor.** Matera, R. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Potts, R.; Prothero, D.H. (International Research and Development Co. Ltd., Newcastle upon Tyne (UK)); Pasotti, G.; Ricci, M.V.; Sacchetti, N.; Spadoni, M. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati). pp N2.2/3 (1-10) of Structural mechanic in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

This paper considers the incorporation of fibre-reinforced composites such as boron/aluminium into the conductor of a demonstration fusion reactor toroidal coils. Such a conductor would be self-supporting against the electromagnetic forces acting on the toroidal coils during operation. The paper considers the stresses to which the conductor would be subjected during coil forming and during operation. It is shown that a reduction in the coil volume and in the coil weight could be achieved, compared with the conventional design, if a composite reinforced conductor were incorporated into the coil. The possible construction of a composite reinforced conductor and the development work which would be required for its manufacture are also considered.

1682 **USA/TNS programs. Engineering considerations.** Shannon, T.E. (Oak Ridge National Lab., TN (USA)); Rawls, J.M. (General Atomic Co., San Diego, CA (USA)). pp N1.1/2 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 1: Engineering concepts and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Studies at the Oak Ridge National Laboratory (ORNL) and the General Atomic Company (GA) have defined basic characteristics and requirements for The Next Step (TNS) in the U.S. Tokamak Development Program. The Reference Design concepts include engineering innovations that have enhanced the feasibility of the tokamak as a power reactor. A major emphasis has been placed on configuration changes to improve access for maintainability, a serious concern and frequent criticism of previous studies. In addition, system designs have been incorporated using existing or modest extensions of engineering technology.

1683 **Mirror fusion reactor design.** Neef, W.S. Jr.; Carlson, G.A.; Moir, R.W. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). pp N1.1/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 1: Engineering concept and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The mirror fusion reactor is a steady state device, not pulsed like most toroidal machines. The magnetic field which confines plasma in a mirror fusion reactor differs greatly from the toroidal magnetic field of the Tokamak. Mirrors are not 'closed' systems. The magnetic field lines leave the plasma region and penetrate the walls of the vacuum chamber in which the plasma has been created. Since charged particles move easily along field lines the plasma could quickly escape to the wall were not for special magnetic field geometry which reflects, i.e., 'mirrors' ions and electrons back toward the hot plasma. The open field lines of mirrors have the distinct advantage of serving as an escape path for ash or impurity ions, leading them out of the plasma to the vacuum pumps.

1684 **Structural engineering problems in FINTOR conceptual designs.** Biggio, M.; Casini, G.; Farfaletti-Casali, F.; Rieger, M; van Rentergheim, J. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Rubinacci, G. (Naples Univ. (Italy). Ist. Elettrotecnico). pp N1.1/5 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics porblems of future fusion reactor power plants. Pt. 1: Engineering concepts and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Conceptual design studies of a Demonstration Fusion Power Reactor are in progress at the JRC-Ispra, in collaboration with the CNEN-Laboratory of Frascati and the Electro-Technical Institute of the University of Naples (FINTOR-Group). The aim of these studies is to define the main features of a Tokamak-type fusion power reactor, demonstrating the feasibility of all technologies required for a prototype commercial reactor. The paper describes some of the results on: a) Structural stability of the outer containment vessel, b) stress analysis of the central magnet support, c) blanket thermal-mechanical behaviour.

1685 **Engineering design of the SOLASE-H laser fusion hybrid reactor.** Abdel-Khalik, S.I.; Conn, R.W.; Moses, G.A.; Cooper, G.W.; Larsen, E.M.; Kulcinski, G.L.; Maynard, C.W.; Ortman, M.S.; Ragheb, M.M.; Sviatoslavsky, I.N. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering. pp N1.2/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 1: Engineering concepts and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland, Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The University of Wisconsin fusion reactor design group has undertaken a study of the technological problems posed by laser fusion hybrids and how they may be integrated into the fission industry. These problems have been examined in the context of a self-consistent reactor design, SOLASE-H. In this article, the engineering design of SOLASE-H is described. This reactor has been designed so that it can be easily integrated into an economy of light water fission reactors with minimum alterations and technology developments in the present fission industry. LWR fuel bundles containing thorium oxide are irradiated in the hybrid until the proper fissile enrichment (3-4%) is reached. The bundles are then shipped directly to the LWRS where the fuel is burnt.

1686 **Fusion reactor safety.** Okrent, D.; Kastenberg, W.E. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). pp N1.2 (1-12) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 1: Engineering concepts and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A number of preliminary conceptual design studies of fusion power reactors have been published, including the Experimental Power Reactor (EPR) designs, the University of Wisconsin Tokamak Designs (UWMAK), and the University of Wisconsin Laser Fusion (SOLASE) design. Because of the early stage in the technological development of fusion power reactors, a wide choice of options in design and in materials and coolants appears to exist. However, it is to be expected that after technical feasibility has been assured, the pressures of reliability and economics will provide strong constraints upon the ultimate designs. And safety will provide still another, often conflicting constraint.

1687 **Thermal analysis of a high-temperature falling bed fusion reactor blanket.** de Paz, J.F.; Harkness, S.D. (Argonne National Lab., IL (USA)). pp N1.3/3 (1-16) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 1: Engineering concepts and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A high temperature, falling bed blanket has been designed for a tokamak fusion reactor. The design centers on the use of a gravity flow of 0.5 to 1.5 cm diameter $Al_2O_3$ balls as the high temperature heat transfer media. This system has the advantage of being able to produce process heat at temperatures in excess of 1000°C while maintaining structural temperatures at approx.400°C. Pumping powers for the system are low. A thermal hydraulic analysis of a representative blanket module has, however, identified several potential problem areas.

1688 **Hydrodynamic effects in inertial fusion reactors.** Thomson, S.L. (Bechtel National, Inc., San Francisco, CA (USA)). pp N1.3/5 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 1: Engineering concept and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The energy yield from the target of an inertially confined fusion reactor is in the form of neutrons, X-rays, and alpha particles and unburned target material ions. Previous reactor design studies have assumed that this energy travels unimpeded to the first wall. However, to transport high current electron beams to the target, a chamber pressure on the order of one-tenth to one atmosphere is required. The particle beam target also has a shell of high atomic number material to absorb the beam energy, resulting in a low X-ray energy (1 keV) and a low ion specific energy (less than 10 keV/amu). Under these conditions, the target debris and X-ray energy is absorbed very near the target and a hydrodynamic shock wave develops in the chamber. A similarity solution exists for the shock motion for strong shocks. Numerical solutions are used for the decay of the shock wave, from a pressure ratio of about ten, to a sound wave. Numerical and approximate methods are used to analyze the development of the shock wave near the target.

1689 **Shock and blast load attenuation in inertial confinement fusion reactors.** Kot, C.A. (Argonne National Lab., IL (USA). Components Technology Div.). pp N1.3/6 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 1: Engineering concepts and thermo-fluid-dynamics of future fusion reactor power plants. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Applying the analysis to a very large yield (0.1 KT) pulsed fusion reactor it is estimated that the presence of helium bubbles in the blanket reduces the peak pressures due to neutron heating by nearly three orders of magnitude. Pressures of 32.4 and 7.7 bar are calculated for void fractions of 5% and 50% respectively. Since the temperature rise is moderate little vaporization is expected and the impulse is estimated at 0.050 bar x sec. Without helium in the blanket the pellet debris blast wave generates pressures at the shield wall of about 9.8 Kbar with an impulse of 0.23 bar x sec. Again the presence of gas bubbles reduces the maximum values to 82 bar for the pressure and 0.054 bar x sec for the impulse. It therefore appears that even for this extremely large yield reactor the structural containment problems may be manageable and that the presence of a substantial gas fraction in the blanket is indeed benficial in reducing shock and blast loads in inertial confinement fusion reactors.

1690 **Finite element structural analysis of coil and casing of a large superconducting toroidal LCT-magnet.** Erb, J. (Karlsruhe Univ. (TH) (Germany, F.R.). Inst. fuer Experimentelle Kernphysik); Gruenhagen, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Kerntechnische Betriebe); Messemer, G.; Zehlein, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp N2.1/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Results for the following problems are presented: i) comparison of ideal shape and final choice of coil contour and ensuing complex body force distribution. ii) prametric study of the influence of support conditions along the inner leg of the coil on hoop stress peaks. iii) stress analyses of the assembled coil and casing under the most critical operational and accidental magnetic loads. iv) containment of quench pressures.

1691 **Mechanical anisotropy in superconducting toroidal coil windings.** Arendt, F.; Dustmann, C.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). pp N2.1/5 (1-2) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

1692 **Method for determining the magnet shape in toroidal arrangements.** Erb, J.; Maurer, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). pp N2.1/6 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The method described here deals with arrangements of a number (M) of ironless coils. A subset (N) of these coils (N <= M) are identical having the contour to be optimized, the other (M-N) coils may be of arbitrary but fixed shape with the restriction that each of the first (N) magnets must see the same magnetic field - as it is the case in toroidal arrangements with additional magnets. From the requirement that the product of the magnetic field and the radius of curvature has a constant value along a certain filament, a system of simple differential equations is established for the contour in question. It is solved numerically taking into account the actual field of the magnets considered. Since the toroidal magnets, the shape of which has to be modified, contribute to the magnetic field, the procedure is necessarily iterative. If the initial form of the toroidal coils (zeroth approximation) is reasonably chosen, the procedure converges to that shape, into which a toroidal system of completely flexible coils would move under the influence of electromagnetic forces only arising from the current flowing.

1693 **Structural analysis of non-circular coils for fusion experiments.** Buck, K.E.; Hammel, J.W. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)). pp N2.1/7 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The toroidal field coils for fusion reactors are often of noncircular shape. This allows to minimize stresses in the coil structure due to operating loads. However, residual stress effects may be induced due to the manufacturing process. The later effects are investigated in this paper.

1694 **Structural analysis of compact experiments for thermonuclear ignition.** Coppi, B. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics); Taroni, A. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Centro di Calcolo). pp N2.1/8 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Compact experiments for the study of $\alpha$-particle heating in high density plasmas have led to verify the feasibility of toroidal magnet configurations, with aspect ratios as low as 2.1 and average magnetic fields of 12.5 T, and of coupled air core transformer systems capable to induce 5 MA of plasma current. The main results of the relevant structural analysis are presented.

1695 **FWLTB - a computer program for predicting the lifetime of a fusion reactor first wall.** Daenner, W.; Raeder, J. (Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). pp N2.3/2 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

FWLTB is a computer program for simulating the First Wall Long Term Behaviour in a fusion reactor environment. It combines nonstationary thermoelastic and long-term inelastic analysis, thus providing a basis for life prediction by comparing the results with a set of constraints on the properties of the material. The present status of program development is briefly summarized and the main features and limitations are outlined. For the reference case already used in earlier publications those results are reported which are subjected to certain limitations. The procedures to be used for life prediction are discussed. It is emphasized that the program, when completed, is expected to be applicable for trend analyses but not yet for accurate prediction of the real wall life.

1696 **Approaches to assessing the failure resistance of fusion reactor first walls.** Odette, G.R. (California Univ., Santa Barbara (USA). Dept. of Chemical and Nuclear Engineering); Reuther, T.C. (Department of Energy, Washington, DC (USA). Office of Fusion Energy); Wolfer, W.G. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). pp N2.3/3 (1-2) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

1697 **First wall and blanket structure performance.** Daenner, W. (Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). pp N2.4/1 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Because of its economic and environmental impact on a fusion power plant, the performance of the first wall and blanket structure has become a key question in fusion reactor development. This paper gives a brief summary of load and operation conditions to which the structure will be exposed in a Tokmakak reactor. Further load conditions prescribed by the blanket design and cooling concept are discussed for three different blanket concepts: the flowing liquid concept, the stagnant liquid concept, and the solid breeder concept. Finally, the necessary procedure for assessing the structural performance in terms of lifetime is outlined and some comments are made about the methods now in use. It is concluded that stronger interaction between the fields of structural mechanics and materials sciences is needed in order to proceed towards more reliable estimates.

1698 **Dynamic and static structural analysis of liquid lithium blanket of fusion power plants.** Masuda, M.; Horie, T.; Yagawa, G.; Ando, Y. (Tokyo Univ. (Japan). Faculty of Engineering). pp N2.4/3 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In several conceptual designs of Tokamak type fusion reactors, liquid lithium is used as the coolant of the blanket together with the purpose of tritium breeding. In such designs, magnetohydrodynamic (MHD) effect is one of the most important problems for the blanket structure because of the high electrical conductivity of liquid lithium. The purpose of this paper is to make clear some of the structural problems concerning the design of liquid lithium blanket of fusion reactor. In this connection, taking UWMAK-III design which was developed at University of Wisconsin, we analyze not only the structural but also thermo-fluid behaviors of liquid lithium blanket..

1699 **Stress analysis of blanket vessel for JAERI experimental fusion reactor.** Sako, K.; Minato, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Fusion Reactor System Lab.). pp N2.4/4 (1-9) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A blanket structure of JAERI Experimental Fusion Reactor (JXFR) consists of about 2,300 blanket cells with round cornered rectangular cross sections (twelve slightly different shapes) and is placed in a vacuum vessel. Each blanket vessel is a double-walled thin-shell structure made of Type 316 stainless steel with a spherical domed surface at the plasma side. Ribs for coolant channel are provided between inner and outer walls. The blanket cell contains $Li_2O$ pebbles and blocks for tritium breeding and stainless steel blocks for neutron reflection. A coolant is helium gas at 10 kgf/cm$^2$ (0.98 MPa) and its inlet and outlet temperatures are 300°C and 500°C. The maxima of heat flux and nuclear heating rate at the first wall are 12 W/cm$^2$ and 2 W/cc. A design philosophy of the blanket structure is based on high tritium breeding ratio and more effective shielding performance. The thin-shell vessel with a rectangular cross section satisfies the design philosophy. We have designed the blanket structure so that the adjacent vessels are mutually supporting in order to decrease the large deformation and stress due to internal pressure in case of the thin-shell vessel.

1700 **Mechanical static analysis of JET vacuum vessel.** Streibl, B. (UKAEA, Abingdon. JET Project); Bourrier, P.; Foult, T. (Societe de Controle Technique et d'Expertise de Construction (SOCOTEC), 75 - Paris (France). Dept. Genie Industriel et Nucleaire). pp N2.4/7 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The large Joint European Tokamak vacuum vessel is built of an assembly of thirty two rigid sectors connected by D-shaped inconel bellows. The purpose of the present analysis is to investigate the stress intensities and the reliability of the bellows when severe loading cases occur.

1701 **Structural design methods for ceramics in fusion reactors.** Trantina, G.G.; Wilkinson, J.P.D. (General Electric Co., Schenectady, NY (USA). Power Generation and Propulsion Lab.). pp N2.4/8 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A feasibility study is made of constructing fusion reactors with materials that have very low neutron activations or very rapid after-heat decay. Certain ceramic materials such as graphite and silicon carbide deactivate many orders of magnitude faster than most metals, and have good high-temperature capabilities as well. The major disadvantage of these ceramics is that they are brittle. The problem is to identify the design, fabrication, and attachment technologies that will be required in order to make structural ceramics feasible in fusion reactors, in spite of intrinsic brittleness.

1702 **Engineering design of a direct-cycle steam-generating blanket for a long-pulse fusion reactor.** Cort, C.E.; Hagenson, R.L.; Teasdale, R.W.; Fox, W.E.; Soran, P.D.; Bathke, C.G.; Cullingford, H.S.; Krakowski, R.A. (Los Alamos Scientific Lab., NM (USA)). pp N2.4/9 (1-12) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

A comprehensive neutronics, thermohydraulic, and mechanical design of a tritium-breeding blanket for use by a conceptual long-pulse Reversed-Field Pinch Reactor (RFPR) is described. On the basis of constraints imposed by cost and the desire to use existing technology, a direct-cycle steam system and stainless-steel construction was used.

1703 **Response of stainless steel to the pellet debris in a laser fusion reactor.** McCarville, T.J.; Hassanein, A.M.; Kulcinski, G.L. (Wisconsin Univ., Madison (USA). Nuclear Engineering Dept.). pp N2.5/4 (1-8) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

Stainless steel has been suggested as a potential first wall material for near term fusion reactors. This work examines the thermal and displacement response of stainless steel at 7 meters from a 100 MJ pellet. For a vacuum chamber the temperature pulse from the photons and charged particles produce a temperature increase in excess of the melting temperature. This increase can be reduced by a factor of 2 with 0.5 torr of neon buffer gas. The evaporation rate can approach several millimeters per year without gas protection and is reduced to 0.03 mm/yr with gas protection. It was found that 0.5 torr of neon could reduce the total dpa at the surface due to ion debris from about 2 x $10^{-4}$ to 1 x $10^{-4}$ dpa per pulse for the spectra chosen. A parameter study examining the response of stainless steel to variations in X-ray spectra and gas parameters show that more than 5.0 torr of xenon gas almost eliminate the temperature rise from soft X-rays and provides some reduction for harder X-rays. The X-ray temperature response is found to be a weak function of the burn time since the thermal diffusivity of stainless steel is low.

1704 **Dynamic loading of the structural wall in a lithium fall fusion reactor.** Glenn, L.A. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). pp N2.5/5 (1-7) of Structural mechanics in reactor technology. Transactions. Vol. N. Thermal, materials engineering, and structural mechanics problems of future fusion reactor power plants. Pt. 2: Structural mechanics problems of fusion power reactors. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland Publishing Co. (1979).

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

In one version of an inertial confinement fusion (ICF) power reactor, the laser-imploded pellet is surrounded by a thick, annular 'waterfall' of liquid lithium. The fall has three functions: to breed tritium for pellet resupply, to act as an energy sink and heat exchange mdeium with an external power loop, and to protect the first wall of the reactor from excessive neutronic and hydrodynamic loading. Our primary concern here is with this last function. We formulated a simple model of a lithium-fall ICF reactor and calculated the fall disassembly and the subsequent fluid-wall interaction resulting from the energy deposition by the imploded pellet. Two potential mechanisms for wall damage were identified: surface erosion and hoop failure. For single fall designs, the erosion problem appears to be serious. Concentric annuli (multiple fall) or packed jet configurations may be feasible but experiments are needed to clarify the physical model, especially with reg (orig.)ard to /orig.the characteristics of the cavitated liquid lithium and of the two-phase liquid-vapor region..

# 99 GENERAL AND MISCELLANEOUS

1705 **(NP—2900461) Engineer's view of science education.** George, D.A. (Science Council of Canada, Ottawa, Ontario). Jun 1981. 32p. Science Council of Canada, Ontario. Order Number DE82900461.

Science education in our schools is a vital part of the preparation for the study and practice of engineering. It is also from the science taught in school that the attitudes of the general public to science, engineering and technology are formed and these attitudes, in turn, have a direct effect on public policies. This paper focuses on these two aspects of science education in presenting an engineering viewpoint (or at least one engineer's viewpoint) of contemporary science education in Canadian schools. The writer is both a practising engineer and an educator. Canada's wealth of physical resources has allowed us to live well in one of the world's most developed countries. But we do not develop our own land; rather, we rely on others to exploit our resources and we are paid a fee for our acquiescence. We benefit in this way from the world's technology and science, and devote our energies to other pursuits; we seem almost deliberately to atrophy our indigenous technological resources. Science education in Canada plays a special role in this policy of perpetual underdevelopment.

## 9902 Mathematics And Computers

*REFER ALSO TO CITATION(S) 148, 234, 384, 460, 576, 914*

1706 (ZfK—410, pp 185-188) **Real-time basic - principles and implementation for KRS 4200 minicomputers.** Grimm, W. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Hoffmann, P. (Ingenieurhochschule Dresden (German Democratic Republic)). Jan 1980. Dep. NTIS (US Sales Only).

From 9. international symposium on the interaction of fast neutrons with nuclei; Gaussig, German Democratic Republic (26 Nov 1979).

A special programming system for the KRS 4200 minicomputer with CAMAC periphery is described. The programming language BASIC has been extended by some types of variables, special statements for CAMAC control commands, CAMAC read/write statements, interrupt handling and bit manipulation. Comfortable programming aids for editing running, debugging, file management allow to work out application programs for nuclear physics experiments.

1707 (ZfK—410, pp 189-191) **CAMAC-monitor for MPS 4944 and SDK-80 microcomputers.** Enghardt, W. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jan 1980. Dep. NTIS (US Sales Only).

From 9. international symposium on the interaction of fast neutrons with nuclei; Gaussig, German Democratic Republic (26 Nov 1979).

The CAMAC-software described in the present article simplifies the development of user-programs for two microcomputer systems with CAMAC-interface, which exist at the Section of Physics of the Dresden Technical University.

1708 **LLNL nuclear chemistry automated production counting facilities: design and implementation.** O'Brien, D.W.; Robinson, S.L.; Hunt, D.N. (Lawrence Livermore Lab., CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 346-350(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

Lawrence Livermore's Nuclear Counting Facilities Upgrade Project was undertaken to replace outdated instrumentation and data and resource control mechanisms. The specification and design of a facilities system for data collection, data flow, and control, from instrumentation to the generation of reports, are discussed. The authors show how a collection of scientific experiments, responsible for production acquisition and handling of data from radiation detection and mass spectroscopy, may be automated.

1709 **CAMAC system test module.** Dawson, W.K.; Gjovig, A.; Naivar, F.; Potter, J.; Smith, W. (Los Alamos Science Lab., NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 1, 375-379(Feb 1981). (CONF-801103—).

From IEEE nuclear science symposium; Orlando, FL, USA (5 Nov 1980).

Since the CAMAC Branch Highway is used to both send information to and receive information from a CAMAC crate, faults in this highway can be difficult to recognize and diagnose. Similarly faults caused by a Crate Controller corrupting either instructions or data are difficult to distinguish from faults caused by the modules themselves. The CLIVIT (CAMAC Logic Integrity Via Interactive Testing) module is designed to largely eliminate such difficulties and ambiguities by allowing the verification of Branch Highway and Dataway transactions via an independent data communication path. The principle of operation of the CLIVIT is explained. Described are the prototype construction, testing and use.

## 9903 Information Handling

*REFER ALSO TO CITATION(S) 1557*

## 9904 Law

*REFER ALSO TO CITATION(S) 1050*

1710 **Opening lecture.** Vogel, H.J. pp 9-16 of Technische Normung und Recht. Referate und Diskussionen. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

In his lecture, the author discusses the question as to whether our technical standards come up to the requirements of our legal system. It is true that acceptance of our technical standards is voluntary but, as in the case of standards issued by the government, standardization will only prove useful when accepted by the majority of the citizens. This becomes evident in cases where the health and quality of life of the citizens has to be defended against the impacts of technical progress. Here, the state has to fulfill a protective function for the benefit of its citizens. Hence the, standardization contract, has been agreed upon in order to guarantee compliance of technical standards and requirements with the interests of public life and health.

1711 **Acknowledged rules of technology as a legal term in public law.** Redeker, K. pp 19-42 of Technische Normung und Recht. Referate und Diskussionen. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

The legal terms such as: acknowledged rules of technology, state-of-the-art, and current state of knowledge in science and technology are explained in detail. Although it has always been a difficult undertaking to incorporate the advances made in the technical domain into our legal system, this task has been and still is fulfilled without implying the necessity of giving up vital claims, neither on the part of the public authorities, nor by the partners in the technological field.

1712 **Relationship between technical standards and legal norms, with special regard to the building law.** Scholz, R. pp 85-107 of Technische Normung und Recht. Referate und Diskussionen. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

The various functions and purposes of technical standards, as well as the different legal statuses of such standards are explained in detail. These rules as a whole represent a standardized system of facts and circumstances that proved to be useful as an acknowledged and legitimate system in addition to and to the service of the constitutional system of legal norms, both systems being independent of each other and serving the purpose of an efficient cooperation on the basis of the constitution.

1713 **Standards and producers' liability.** Kretschmer, F. pp 169-177 of Technische Normung und Recht. Referate und Diskussionen. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

The author discusses the liability of producers and the diligence required, which has to come up to technical standards and the latest state of technology. The consequences of this requirement with regard to claims for damages are outlined and proposals for reforms are pointed out.

1714 **Technical standards and quality assurance.** Ziemsen, K. pp 179-185 of Technische Normung und Recht. Referate und Diskussionen. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

The legal character of DIN standards is discussed on the basis of several judgments issued by the Supreme Court of the Federal Republic of Germany. The author holds the view that DIN standards are mere descriptions of quality, wheras the relevant literature tends to assume the intention to guarantee a specified quality of goods.

1715 **Legal advantages for those complying with technical standards.** Korbion, H. pp 187-198 of Technische Normung und Recht. Referate und Diskussionen. Berlin, Germany, F.R.; Beuth (1979). (In German)

From Meeting on technical standards and legislation; Koeln, F.R. Germany (12 Jun 1979).

The set of German standards is of legal relevance, as these standards offer security in the process of law for those complying with the standards. In case of disputes, a producer accepting and complying with the standards has an advantage over the opposing party: the odds are on his side, as the appearance of conformity of goods supplied to agreed standards speaks in favor of the supplier, whereas the opposing party has to demonstrate that the standard in question is not correct as it does not come up to the acknowledged state of technology.

# CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.


## B

**Bituminous Coal Research, Inc., Monroeville, PA (USA)**
Mine demonstrations of longwall dust-control techniques. Phase I status report, 7:4 (BCR-L—1245)

## C

**California Energy Resources Conservation and Development Commission, Sacramento (USA)**
Compliance plan for PG and E geysers unit 16, 7:272 (P—800-81-005)
USGS and Engineering and Environmental Division joint compliance monitoring report for Sacramento, CA Municipal Utility District's SMUDGEO No. 1 Geothermal project. Appendix D to final decision, 7:271 (P—800-81-003)

**Committee on Energy and Natural Resources (U.S. Senate), Washington, DC**
Pacific basin energy, 7:629 (PUBL—96-145)

**Committee on Science and Technology (U.S. Congress. House), Washington, DC Subcommittee on Energy Research, Development and Demonstration (Fossil Fuels)**
Oversight: DOE solar and conservation programs, 7:627 (GPO—65-855)
Wind energy systems act of 1980, 7:273 (GPO—56-735)

## D

**Dynecology, Inc., Harrison, NY (USA)**
Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge, 7:638 (NYSERDA—81-6)

## F

**Foster Wheeler Boiler Corp., Livingston, NJ (USA)**
Operating experience with a fluidized bed steam generator at Georgetown University, 7:905 (CONF-8004173—11)

## N

**National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center**
Toroidal cell and battery, 7:606 (NASA-CASE-LEW—12918-1)

**National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center**
Solar tracking system, 7:259 (NASA-CASE-MFS—23999-1)

**National Oceanic and Atmospheric Administration, Washington, DC (USA). Center for Environmental Assessment Services**
Climate impact assessment: United States, 7:980 (NP—2900749)

**New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)**
Geology and mineral technology of the grants uranium region 1979, 7:59 (CONF-7905120—)

## S

**Science Council of Canada, Ottawa, Ontario**
Engineer's view of science education, 7:1705 (NP—2900461)

**Southern States Energy Board, Atlanta, GA (USA)**
Low-level radioactive waste management: a regional compact, 7:242 (NP—2900891)
Low-level radioactive waste management: an economic assessment, 7:185 (NP—2900892)

**SRI International, Menlo Park, CA (USA)**
California energy futures: a presentation made to the California Energy Commission, 7:628 (P—300-80-033)

**State Planning Council on Radioactive Waste Management, Washington, DC (USA)**
High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state, 7:226 (NP—2900750)
Low-level radioactive waste management: an economic assessment, 7:185 (NP—2900892)
Low-level radioactive waste management: case studies on commercial burial sites, 7:189 (NP—2900893)
Low-level radioactive waste management: charting state issues and responsibilities, 7:613 (NP—2900890)
Recommendations on national radioactive waste management policies: report to the President, 7:241 (NP—2900894)

# PERSONAL AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. Report numbers, if applicable, are given in parentheses at the end of the entry. For publications with multiple authors, an author entry is provided for each. Entries for the second and succeeding authors give references to the first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

## A


**Aas, S.,** *See* Lunde, L., 7:492

**Abashian, A.,** *See* McCal, D., 7:1499

**Abbotts, I.,** *See* Fyfe, J.A., 7:31

**Abdel-Khalik, S.I.,** Engineering design of the SOLASE-H laser fusion hybrid reactor, 7:1685

**Abraham, M.M.,** *See* Floran, R.J., 7:720

**Abramowicz, H.,** Inclusive distributions in double scattering process in $\pi^-$d interactions at 205 and 360 GeV/c, 7:1493

**Abrams, C.S.,** *See* Mann, S.A., 7:192

**Abrams, G.S.,** *See* Scharre, D.L., 7:1489

**Abramyan, L.O.,** Pion minus photoproduction on neutrons by polarized photons in the 0.9-1.65 GeV energy range, 7:1482 (KFTI—80-6, pp 8-9)

**Abrosimov, A.T.,** Coherent (1), semicoherent (2) and incoherent (3) interactions on nuclei at 40 GeV/c, 7:1491

**Absi, E.,** Numerical methods for engineering, 7:571

**Ache, H.J.,** New developments in positron and positronium chemistry, 7:1386

*See* Handel, E.D., 7:1385

**Ackerman, R.H.,** *See* Correia, J.A., 7:1087

**Adams, D.F.,** Sulfur gas emissions from stored flue gas desulfurization sludges, 7:1005

**Adams, J.S.,** *See* Holick, M.F., 7:1173

**Adams, N.J.I.,** 2- and 3-dimensional elasto-plastic finite element analysis of an SENB fracture specimen, 7:461

**Adams, W.M.,** *See* Bratenahl, A., 7:1292

**Admon, U.,** New electron gun for the S-600 scanning electron microscope, 7:974 (IA—1356, pp 306-307)

**Aeikaes, O.,** Uraniferous phosphorite and apatite-bearing gneisses in the Proterozoic of Finland, 7:92

**Aerne, E.T.,** *See* Bart, G., 7:945

**Afanasiev, A.G.,** *See* Shamov, A.I., 7:769

**Afonin, A.A.,** Field model of photonuclear reactions, 7:1622 (KFTI—79-48, pp 43-44)

**Agan'yants, A.O.,** *See* Abramyan, L.O., 7:1482

**Agee, L.J.,** Power series solutions of the thermal-hydraulic conservation equations, 7:902

**Aggarwal, S.K.,** *See* Chitambar, S.A., 7:780

**Ahalpara, D.P.,** Collective bands of positive parity states in (FP) shell nuclei, 7:1586

**Ahluwalia, H.S.,** Solar polar field reversals and secular variation of cosmic ray intensity, 7:1301

**Ahmad, M.M.,** *See* Khan, A., 7:963

**Ahmad, S.,** Internal and external bremsstrahlung spectra in thick lead and aluminium targets excited by soft beta rays, 7:1643

**Aihara, S.,** Computer program system for structural design of nuclear power plants, 7:576

*See* Muto, K., 7:574

**Ainscough, J.B.,** In-reactor densification and relocation of $UO_2$ pellet fuel: preliminary results from the Springfields programme, 7:484 (IWGFPT—7, pp 228-235)

**Aird, H.M.,** Surveillance of prestressed concrete pressure vessels under commissioning and operational conditions at Hunterston 'B' Power Station, 7:370

**Airey, P.L.,** Aspects of the isotope hydrology of two sandstone aquifers in arid Australia, 7:1017

**Aitbaev, F.B.,** Definition of solar cosmic ray energy spectra in a source, 7:1277 (INIS-mf—6290, pp 4-5)

**Akhachinskii, V.V.,** Enthalpy of formation of YHsub(1.994) and YHsub(2.792), 7:817

Thermodynamic instability of a solid solution of aluminium in plutonium (delta-phase) at room temperature, 7:851

**Akiyama, M.,** *See* Narita, M., 7:937

**Aksenov, M.S.,** Critical field emission currents initiating vacuum breakdown for metals cooled up to liquid-helium temperatures, 7:1444

**Alam, M.S.,** *See* Scharre, D.L., 7:1489

**Alaniya, M.V.,** Structure of the neutral sheet of the interplanetary magnetic field according to measurements of cosmic ray intensity and anisotropy, 7:1282 (INIS-mf—6385, pp 124-125)

**Alberman, A.,** Dosimetry experiment 'Dompac'. Neutronic simulation of the thickness of a PWR pressure vessel. Irradiation damage characterization, 7:289 (EUR—6813(Vol.1), pp 407-428)

**Albini, E.,** *See* Abrosimov, A.T., 7:1491

**Aldridge, J.P.,** *See* McDowell, R.S., 7:829

**Alekseeva, Z.M.,** Phase equilibria in the uranium-chromium-carbon system, 7:671

**Allard, B.,** Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216

*See* Andersson, K., 7:210

**Allemmoz, M.,** Recharge of groundwaters in arid areas. Case of the Djeffara plain in Tripolitania, Libyan Arab Jamahiriya, 7:1022

**Almendral, A.,** *See* del Re Brun, R.M.G., 7:1097

**Alpert, N.,** *See* Correia, J.A., 7:1087

**Alspector, J.,** *See* McCal, D., 7:1499

**Altenhein, F.K.,** Mechanisms for hydrothermal leaching of glass and glass-ceramic nuclear waste forms, 7:717

**Alter, U.,** Protection and security of transport of special nuclear materials (including measures for the transportation by rail:, 7:180 (INIS-mf—6447, pp vp)

**Alurkar, S.K.,** Interplanetary scintillation - preliminary observations at 103 MHz, 7:1352

*See* Sawant, H.S., 7:1330

**Alyushin, A.S.,** *See* Natarov, V.V., 7:1107

**Ambartsumyan, V.A.,** Inverse problems of astrophysics, 7:1287 (JINR-D—12831, pp 9-20)

**Amiel, S.,** Measurement of very short-lived nuclides. Chapter 3. Section 4, 7:751

Neutron counting in activation analysis. Chapter 3. Section 3, 7:750

*See* Mantel, M., 7:749

**Amonenko, V.M.,** Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25, pp 57-62)

**Amzallag, C.,** *See* Bosser, M., 7:314

**Anand, A.K.,** Inpile irradiations for verification of pellet clad interaction predictions, 7:497 (IWGFPT—8, pp 31-33)

**Ananjeva, M.A.,** *See* Abrosimov, A.T., 7:1491

**Anantharaman, K.,** *See* Anand, A.K., 7:497

**Andersen, C.,** *See* Day, G.A., 7:17

**Anderson, D.A.,** *See* Paul, W., 7:251

**Anderson, R.,** *See* Ellis, R.G., 7:1508

**Andersson, K.,** Diffusion of cesium in concrete, 7:210

*See* Allard, B., 7:216

**Ando, K.,** *See* Susukida, H., 7:665

**Ando, S.,** *See* Ogata, Y., 7:412

**Ando, Y.,** *See* Masuda, M., 7:1698

*See* Ohashi, N., 7:668

*See* Susukida, H., 7:665

**Andreeva, L.N.,** *See* Parshutin, V.V., 7:686

**Andrews, S.M.,** *See* Schreiber, H.D., 7:201

**Andrews-Speed, C.P.,** *See* Oxburgh, E.R., 7:23

**Andrusenko, V.V.,** *See* Blokh, K.O., 7:1222

**Angerstein, W.,** Problems of image quality, radiation burden and risk/

benefit ratio in mammography, 7:1244 (INIS-mf—6421, pp 7)
**Annen, K.D.,** Electron and positive-ion measurements in MHD combustion plasmas with phosphorous addition, 7:634
**Anovski, T.,** Determination of biogeochemical and radioecological characteristics of the Vardar River system, 7:1040 (IAEA-TECDOC—229, pp 159-173)
**Anspach, W.,** Transport of spent light water reactor fuel by goods train. Estimation of potential release in the event of accidents, 7:173 (INIS-mf—6447, pp vp)
*See* Schneider, K., 7:175
**Anthony, P.J.,** *See* Hegge, M.R., 7:69
**Antonov, E.E.,** Inversion of excited atom states in cesium and nitrogen-cesium plasma, 7:896
**Antsipov, G.V.,** Evaluation of nuclear data for $^{242}$Pu in the region of resolved and unresolved resonances ($10^{-5}$ eV-200 keV), 7:1601 (INDC(CCP)—150/LJH, pp 1-41)
**Antuf'ev, Yu.P.,** Determination of oxygen, carbon and nitrogen in calcium by the gamma activation method, 7:742 (KFTI—79-40, pp 35-36)
**Arai, K.,** *See* Igarashi, T., 7:597
**Araki, H.,** *See* Hirano, T., 7:684
**Arbo, J.C.,** Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge, 7:638 (NYSERDA—81-6)
**Arendt, F.,** Mechanical anisotropy in superconducting toroidal coil windings, 7:1691
**Arkatov, Yu.M.,** Mechanism of three-particle photodisintegration of $^4$He, 7:1564 (KFTI—79-48, pp 62-65)
**Armstrong, C.W.,** Comparison of exploration techniques in Saskatchewan and the Northern Territory, 7:135
**Arnal, Y.,** *See* Pomathiod, L., 7:1391
**Arnold, F.,** Middle atmosphere ionized component, 7:1381 (ESA-SP—152, pp 479-496)
**Aronson, S.,** Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys, 7:683
**Arora, O.P.,** *See* Das, M., 7:381
**Arskaya, E.P.,** *See* Parshutin, V.V., 7:686
**Artieda, J.,** *See* Serrano, J.R., 7:152
**Asada, Y.,** Fatigue crack propagation under elastic plastic medium at elevated temperature, 7:664
**Aschl, H.,** Concrete for PCRV's: Mechanical properties at elevated temperatures and residual mechanical behaviour after triaxial preloading, 7:738
**Asghar, M.,** Passive $\gamma$-ray monitoring of plutonium contaminated waste, 7:237 (EUR—6813(Vol.2), pp 811-818)
**Aslamazishvili, R.G.,** *See* Alaniya, M.V., 7:1282
**Asmis, G.J.K.,** *See* Atchison, R.J., 7:386
**Aspin, N.,** Public attitudes towards the nuclear industry in Canada, 7:617
**Assedo, R.,** Nuclear reactor surveillance - neutron noise measurements and vibration analysis on French PWR internal structures, 7:538
Vibration studies on a three-loop PWR internals model, 7:321
**Assido, C.,** *See* Pasi, M., 7:931
**Assis, T.,** *See* Keren, M., 7:932
**Atabek, R.,** Pellet cladding interaction. Mechanical and chemical approach to modelling, 7:305 (IWGFPT—8, pp 128-141)
*See* Vignesoult, N., 7:507
**Atar, E.,** *See* Admon, U., 7:974
**Atchison, R.J.,** Behaviour of concrete containment under over-pressure conditions, 7:386
**Atkinson, P.,** *See* Lehrbach, P.R., 7:1155
**Atsumi, K.,** *See* Aihara, S., 7:576
**Auerbach, N.,** Excited states in light hypernuclei from ($K^-,\pi^-$) reactions, 7:1580 (TRI—79-1, pp 128-132)
**Auf der Maur, A.N.,** Simple method for collection of HTO from air, 7:955
**Auluck, S.,** Superconductivity in scandium-zirconium systems, 7:1655
**Austin, S.R.,** Dissolution and authigenesis of feldspars, 7:106
**Avakyan, R.O.,** *See* Abramyan, L.O., 7:1482
**Avraimova, M.T.,** *See* Kogan, I.A., 7:1217
**Avrutskii, V.A.,** Vacuum breakdown along a dielectric surface with an accumulated charge, 7:1449
**Awadalla, M.S.,** Review of soil conservation in the Sudan (1940-1979), 7:1132 (IAEA-TECDOC—236, pp 107-114)
**Axler, R.P.,** *See* Gersberg, R.M., 7:1010
**Ayres, D.E.,** *See* Binns, R.A., 7:79
**Aziz, T.S.,** Nonlinear transient dynamic response of pressure relief valves for a negative containment system, 7:392
Seismic interaction effects for steam generators in CANDU 600 MWe nuclear power plants, 7:594

## B

**Bacca, J.P.,** Postirradiation handling and examination at the HFEF complex, 7:887
**Backe, H.,** Positron production in heavy ion collisions, 7:1411
**Badawi, A.E.,** *See* Awadalla, M.S., 7:1132
**Badiello, R.,** Chemical protection and sensitization to ionizing radiation molecular investigations, 7:1198
**Bagger, C.,** Computer based recording and handling of non-destructive PIE data at Risoe, 7:874
*See* Knudsen, P., 7:490
**Bahl, J.K.,** Post-irradiation examination at Radiometallurgy Division, BARC, Bombay, 7:341
*See* Sahoo, K.C., 7:277
**Baier, K.,** *See* Heumann, K.G., 7:765
**Baier, R.,** Symmetric hadron pairs at large transverse moments as a test of the QCD model, 7:1542
**Baikova, V.P.,** *See* Beletskii, V.I., 7:1238
**Bainbridge, A.,** Commissioning and subsequent development of boiler feedwater control systems on the Prototype Fast Reactor, 7:426
**Bair, W.J.,** Biological effects of inhaled radionuclides. Summary of ICRP report 31, 7:1184
**Baird, C.W.,** Comparison of braided-stream depositional environment and uranium deposits at Saint Anthony underground mine, 7:121
**Bairiot, H.,** Statistical trends observed in published data of PCI failures, 7:499 (IWGFPT—8, pp 57-64)
**Baisakalova, A.B.,** *See* Aitbaev, F.B., 7:1277
**Bakhanovich, L.A.,** *See* Antsipov, G.V., 7:1601
**Bakshi, A.K.,** Oxygen isotope geothermometry on high-grade metamorphic rocks, 7:1275
**Balakrishna, P.,** Fabrication of burnable poison fuel pellets for TAPS - plant experience, 7:287
**Balazs, G.B.,** *See* Schreiber, H.D., 7:201
**Baloshin, O.N.,** Observation of new lambda anti lambda states, 7:1495
**Balukova, V.D.,** *See* Spitsyn, V.I., 7:215
**Baluszka, J.C.,** Exploitation study of the ore-body "Tigre III". Open-cut design and study of high-recovery underground mining method for the Tigre III ore-body, 7:153
**Bancroft, G.M.,** *See* Karkhanis, S.N., 7:202
*See* Nesbitt, H.W., 7:203
**Bandyopadhyay, A.K.,** Electrical resistivity of I indium sulphides (InS) crystals down to 4.2deg K and upto 80 kilobar, 7:1654
**Bandyopadhyay, S.K.,** *See* Chaki, S.K., 7:394
**Banerjee, S.,** *See* Mukhopadhyay, P., 7:643
**Banks, D.A.,** Some Windscale experience of the underwater examination of water reactor fuel assemblies, 7:284
**Bannenberg, J.G.,** Beam transport for ion implantation, 7:910
**Bannyi, A.V.,** Application of radioisotopic indication by chromium-51 in diagnosis of injuries of circulating blood volume in local peritonits, 7:1117
**Bannyj, A.V.,** *See* Lutsenko, S.M., 7:1115
**Banyr, J.,** *See* Sulc, V., 7:399
**Baptista, G.B.,** *See* Paschoa, A.S., 7:1190
**Baran, A.,** *See* Anspach, W., 7:173
**Barcinski, M.,** *See* Cullen, T.L., 7:1189
**Barcz, A.,** Quantitative analysis of III-V compounds, using low-energy ion-scattering spectrometry (ISS), 7:772
**Bardadin-Otwinowska, M.,** Production of large Psub(T) single particles and multiparticle systems (jets) in $K^-$p interactions at 110 GeV/c, 7:1490
**BarGoum, R.S.,** Simplified methods in inelastic analysis, 7:465
**Barkov, B.P.,** *See* Baloshin, O.N., 7:1495
**Barloutaud, R.,** Meson production in $K^-$p interactions at 70 GeV/C, 7:1494
**Barnard, P.C.,** Oils and source rocks of the North Sea area, 7:25
**Barnes, G.,** *See* Gray, W.D.T., 7:40
**Barnett, B.,** *See* Stroynowski, R., 7:1488
**Baro, G.,** Detection of failed fuel rods ir irradiated fuel assemblies, 7:307
**Barr, K.W.,** Geology of the Cardigan Bay-St. George's Channel Basin, 7:
**Barrada, Y.,** Research techniques in so moisture regimes under rain-fed agriculture, 7:1125 (IAEA-TECDOC—236, pp 86-94)
**Barrados, M.,** Trends in public opinic The national scene, 7:625
**Barrett, T.R.,** PFR reprocessing pla cave, 7:866

**Barsotti, E.,** *See* Larwill, M., 7:914
**Bart, G.,** Modification of an A-DIDA secondary ion mass spectrometer to allow the examination of α- and β/γ-emitting specimens, 7:945
**Basilova, R.N.,** Observations of magnetospheric proton fluxes with energy more than 25 KeV in the interplanetary medium in March-April 1977, 7:1383 (INIS-mf—6290, pp 68-69)
**Baskin, L.M.,** *See* Aksenov, M.S., 7:1444
**Basler, W.D.,** Influence or preparation methods on structural integrity of Na-A and Na-α zeolites and on occlusion of aluminum compounds studied by H-NMR of sorbed water and ammonia, 7:730
**Bassett, R.L.,** Predicting the reaction state of brines in proposed regions of nuclear waste isolation, 7:195
**Bassetto, A.,** Colour singlets in perturbative QCD, 7:1545
**Bassingthwaighte, J.B.,** *See* Lemon, G.J., 7:1078
**Basu, A.N.,** Polarisable dipole models for ionic solids and their quantum mechanical justification, 7:735
*See* Ghosh, A., 7:734
*See* Ghosh, S., 7:710
**Basu, S.,** *See* Anand, A.K., 7:497
**Bath, L.J.,** Development of the Alligator Rivers uranium deposits, 7:154
**Bathke, C.G.,** *See* Cort, C.E., 7:1702
**Battist, L.,** Radiological consequences of the Three Mile Island accident, 7:1187
**Bauchede, J.,** *See* Zecevic, V., 7:877
**Bauer, G.J.,** *See* Peagram, G.W., 7:870
**Baum, P.J.,** *See* Bratenahl, A., 7:1292
**Baumgartner, S.,** Radiation sensitivity of tetrahymena pyriformis, 7:1152 (INIS-mf—6531, pp vp)
**Bayer, A.,** *See* Huebschmann, W.G., 7:567
**Baylac, G.,** *See* Assedo, R., 7:321
**Baylis, C.C.,** Prediction of the optimum filling pressure for PWR fuel rods, 7:300 (IWGFPT—7, pp 180-189)
**Bazell, C.C.,** *See* Clay, B.D., 7:164
**Bazergui, A.,** Tests on a 1,75 m O.D. bolted flange assembly with spiral-wound gaskets, 7:391
**Bazzano, A.,** *See* Ubertini, P., 7:948
**Beahm, E.C.,** *See* Besmann, T.M., 7:707
**Beary, M.M.,** *See* Schulz, W.W., 7:199
**Beastall, G.,** *See* Lindsay, R., 7:1076
**Beau, G.,** *See* Schott, R., 7:766
**Beaver, P.F.,** Flexibility in radiation protection legislation. The UK approach, 7:630
**Beck, F.,** High spin isomeric states in $^{132}$Dy, 7:1592 (INP—1014/PL, pp 43-48)
**Beck, R.G.,** Jackpile-Paguate deposit: a review, 7:144
**Becker, D.A.,** High purity materials, standards, and reference materials. Chapter 5. Section 4, 7:758
**Becker, M.,** *See* Ryskamp, J.M., 7:407
**Bedjidian, M.,** Possible observation of a γ-transition in the $\Lambda^{8}$Li hypernucleus, 7:1581 (TRI—79-1, pp 133-135)
**Bedrosian, B.,** Dynamic pressures in annulus-shaped pressure suppression pools of boiling water reactors generated by earthquake ground motions, 7:575
**Beer, F.,** *See* Heumann, K.G., 7:765
**Begovic, J.,** Dynamics of Cs-137 distribution in the muscle tissue of swine by single and repeated contamination, 7:1202
**Behera, S.N.,** Two-phonon bound states in imperfect crystals, 7:1653
**Bel, N.,** Reflexion and transmission of Alfven waves in an atmosphere, 7:1305
**Beletskii, V.I.,** Radioisotopic study on the thyroid after surgical treatment of patients with different form of goiter, 7:1108
X-ray therapy of calcaneal spur, 7:1238
**Bellaiche, H.,** *See* Zecevic, V., 7:877
**Belletini, G.,** Production of lepton pairs at the ISR, 7:1497
**Belousov, A.S.,** Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV, 7:1576 (KFTI—80-6, pp 6-7)
**Belousova, L.G.,** *See* Davydova, L.I., 7:1104
**Belyaev, V.A.,** Structure of Forbush decreases during geomagnetic storm development with sudden commencement according to observations in the Arti observatory during 1978, 7:1279 (INIS-mf—6290, pp 51)
**Benedekne-Lazar, M.,** Effect of gamma irradiation on the lysine content of plants, 7:1141 (INIS-mf—6050, pp 282-284)
**Benita, S.,** *See* Shani, J., 7:1199
**Benner, L. Jr.,** *See* Driver, E.T., 7:858
**Bennett, M.J.,** Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358
**Benninghoven, A.,** *See* Tuempner, J., 7:950
**Bentley, M.E.,** *See* Bassett, R.L., 7:195
**Benz, A.O.,** Solar radar observations, 7:1306
**Berenyi, D.,** *See* Mukoyama, T., 7:1399
**Berezovoj, V.P.,** Effects of final-state interactions in the $^{12}$C(e,e'p)$^{11}$B reaction, 7:1577 (KFTI—80-6, pp 43-44)
**Berg, E.,** *See* Rekstad, J., 7:1588
**Bergenlid, U.,** Examination of fuel rods by means of neutron radiography, 7:515
Experimental observations of the PCI failure occurrence on power ramping, 7:491 (IWGFPT—8, pp 121-127)
**Berger, L.,** *See* Kramer, E., 7:636
**Berggren, W.A.,** Agglutinated benthonic foraminiferal assemblages in the Palaeogene of the central North Sea: their biostratigraphic and depositional environmental significance, 7:35
**Bergquist, L.E.,** *See* DeVoto, R.H., 7:149
**Bergstroem, A.,** *See* Pusch, R., 7:219
**Berkman, D.A.,** Geology of the Litchfield province, N.T., 7:1259
Mount Fitch copper and uranium deposits, Rum Jungle Uranium Field, N.T., Australia, 7:73
**Bernard, Ph.,** *See* Dehon, C., 7:306
**Bernard-Connolly, M.,** Low cycle fatigue behaviour and cumulative damage effect of SA-516-70 steel at room and high temperature, 7:661
**Bernardo, B.C.,** Need for emergency preparedness in transport of radioactive materials, 7:857 (INIS-mf—6447, pp vp)
**Bernhart, J.,** *See* Duftschmid, K.E., 7:952
**Beslu, P.,** *See* Lambert, I., 7:816
**Besmann, T.M.,** Thermodynamic studies of thorium carbide fuel preparation and fuel/clad compatibility, 7:707
**Bessent, R.G.,** *See* Lindsay, R., 7:1076
**Best, J.V.,** Modelling of AGR radiolytic graphite corrosion, 7:363
**Bethmont, M.,** Crack growth rate of PWR piping, 7:327
**Betz, W.,** *See* Kirsch, J., 7:1410
*See* Soff, G., 7:1409
**Beyen, H.,** Rescue container to accommodate defective transport containers filled with uranium hexafluoride, 7:859 (INIS-mf—6447, pp vp)
**Bhardwaj, S.A.,** *See* Chhatre, A.G., 7:385
*See* Das, M., 7:381
**Bhat, A.N.,** *See* Mittal, M.L., 7:1480
**Bhat, I.S.,** Fate of major radionuclides in the liquid wastes released to coastal waters, 7:1047
**Bhat, R.L.,** *See* Bandyopadhyay, A.K., 7:1654
**Bhatnagar, A.,** Flare associated eruptive prominence activity of February 1, 1979, 7:1326
**Bhatt, K.H.,** *See* Ahalpara, D.P., 7:1586
**Bhide, V.G.,** Design and fabrication of a high homogeneity high field superconducting magnet, a metal cryostat and a high stability energiser, 7:1660
**Bhonsle, R.V.,** *See* Alurkar, S.K., 7:1352
*See* Bhatnagar, A., 7:1326
*See* Degaonkar, S.S., 7:1323
*See* Sawant, H.S., 7:1330
**Bialkowska, H.,** Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**Bibikova, E.V.,** Internal isochrone method in accessory zircon dating, 7:1271
**Bick, Y.A.E.,** Chemical protection against x-ray damage to animal cells in vitro, 7:1246 (INIS-mf—6531, pp vp)
**Biedermann, P.,** *See* Stoever, D., 7:348
**Bienik, J.,** Study of the tightness of the rock cover of the Suchohrad-Gajary underground natural gas reservoirs using nuclear logging methods, 7:58 (INIS-mf—6422, pp vp)
**Bienlein, J.K.,** Observation of an excess of events in $e^+e^-$ annihilations into neutral final-states leading to three electromagnetic showers at 10 GeV, 7:1496
**Biggio, M.,** Structural engineering problems in FINTOR conceptual designs, 7:1684
**Biggs, W.G.,** Air-quality impacts from Western Surface-coal-mining operations, 7:999
**Billiris, B.,** *See* Smith, D.W., 7:1486
**Billy, M.,** *See* Cartz, L., 7:719
**Binns, R.A.,** Origin of uranium mineralization at Jabiluka, 7:85
Petrology and geochemistry of alteration associated with uranium mineralization at Jabiluka, Northern Territory, Australia, 7:79
*See* Riley, G.H., 7:1261
*See* Ryall, W.R., 7:1273
**Bird, E.J.,** *See* Curren, W.D., 7:846

**Bird, K.,** *See* Porsche, H., 7:1365
**Bird, M.K.,** Cross sectional magnetic profile of a coronal transient, 7:1357
**Biron, A.,** *See* Bernard-Connolly, M., 7:661
**Bischof, W.,** Legal provisions concerning the handling and disposal of radioactive waste in international and national law, 7:223
**Biver, E.,** Some improvements in handling techniques into commercial nuclear reactors, 7:871
*See* Pietz, M.R., 7:888
**Bjoern, L.,** *See* Kopp, E., 7:1374
**Blaha, F.,** Application of gamma-gamma logging method in the prognosis of anomalous geodynamic effects in hard coal mines, 7:11 (INIS-mf—6422, pp vp)
*See* Keclik, L., 7:12
**Blanchard, A.,** Carbon deposition on 20/25/Nb steel using an electrically heated AGR fuel pin, 7:359
Development of transport and non-transport porosity in radiolytic graphite oxidation, 7:721
Graphite oxidation experiment to high weight loss under CAGR conditions, 7:362
**Blank, H.,** Steady state fission gas kinetics in nuclear fuel at lower temperatures, 7:473 (IWGFPT—7, pp 76-96)
**Blazek, M.,** Exact solution of the inverse scattering problem at fixed energy, 7:1553 (INIS-mf—6479, pp vp)
**Blocker, C.A.,** *See* Scharre, D.L., 7:1489
**Blockus, D.,** *See* Stroynowski, R., 7:1488
**Blokh, K.O.,** RNA biosynthesis in rabbit skeletal muscles in case of combined radiation injury, 7:1222
**Blondel, A.,** *See* Scharre, D.L., 7:1489
**Bloom, E.E.,** Mechanical properties of materials in fusion reactor first-wall and blanket systems, 7:679
**Blum, P.T.,** *See* Kirchner, B., 7:853
**Blundell, D.J.,** Nature of the continental crust beneath Britian, 7:1248
**Boatner, L.A.,** *See* Floran, R.J., 7:720
**Boccaccini, L.,** *See* Ubertini, P., 7:948
**Bochek, G.L.,** Relativistic electron radiation in diamond monocrystal, 7:1640 (KFTI—79-57, pp 44-47)
**Bodenhausen, J.W.A.,** Habitat of the Rijswijk oil province, onshore, the Netherlands, 7:36
**Boegner, P.L.E.,** *See* Glennie, K.W., 7:21
**Boerio-Goates, J.,** *See* Flotow, H.E., 7:813
**Boguslyavskij, V.B.,** Choice of the method and reagents for maintenance washing and decontamination of the NPP equipment, 7:470
**Bohacek, V.,** *See* Vana, J., 7:1456
**Bohlin, J.D.,** Program for the observations of the Sun and heliosphere from space 1980-1995, 7:1364
**Bohmeyer, W.,** Current-voltage behaviour of non-LTE pulse discharges, 7:1442
**Boisserie, J.M.,** Order, heat, intrinsic dissipation and inelastic analysis, 7:1663
**Bokhan, P.A.,** Peculiarities of electric discharges in mixtures of metal vapors and rare gases at increased pressures, 7:895
**Boldyshev, V.F.,** Theory of electron-positron pair production at superhigh energy, 7:1500 (KFTI—80-6, pp 86-90)
**Bolonkin, B.V.,** *See* Baloshin, O.N., 7:1495
**Bon Mardion, G.,** Performance of a cryogenic distillation system for purifying the argon cover gas in a fast reactor, 7:427
**Bond, R.D.,** *See* Curren, W.D., 7:846
**Bondar, L.,** *See* Asghar, M., 7:237
**Bongartz, K.,** Stress performance calculations as a guide for layout and testing of coated fuel particles for HTRs, 7:171
*See* Gehr, H.L., 7:170
**Bonin, W.,** *See* Backe, H., 7:1411
**Bonner, W.A.,** *See* Lemmon, R.M., 7:837
**Bonniaud, R.,** Melting process to condition decladding hulls generated by the reprocessing of LWR and FBR spent fuels, 7:211
**Bonotto, S.,** Radiobiological and radioecological studies with the unicellular marine algae Acetabularia, Batophora and Dunaliella, 7:1192
**Bordeaux, M.,** *See* Chauvet-Deroudilhe, M., 7:956
**Bordet, R.,** Design and construction of the prestressed concrete containments of the French standard 900 MWe PWR, 7:316
**Borenstein, S.,** *See* McCal, D., 7:1499
**Borisov, B.K.,** Main regularities of $^{90}Sr$ migration in mother-fetus biological system. Chapter 5.2, 7:1181
**Borisova, T.S.,** *See* Pokrovskaya-Soboleva, A.S., 7:1450
**Borkowski, A.,** Shakedown analysis by finite element incremental procedures, 7:1668
**Bornscheuer, F.W.,** Experimental study of a spherical PWR-containment with geometrical imperfections at the welds, 7:318
*See* Saettele, J.M., 7:319
**Borovikova, N.M.,** *See* Mukhin, I.E., 7:1233
**Bose, S.K.,** *See* Maurya, A.L., 7:966
**Bosqued, J.M.,** *See* D'Uston, C., 7:1303
**Bosser, M.,** Verification of the resistance of PWR thermal sleeves to thermal fatigue, 7:314
**Bosser, R.,** Study of devices for the non destructive examination of drums containing low activity waste by neutron transport and gamma radiation codes, 7:236 (EUR—6629, pp 383-406)
**Boswell, R.,** *See* Pomathiod, L., 7:1391
**Bouffioux, P.,** *See* de Meulemeester, E., 7:488
**Boukamp, B.A.,** All-solid lithium electrodes with mixed-conductor matrix, 7:607
**Bourgeois, P.,** Behaviour of fission products in PWR primary coolant and defected fuel rods evaluation, 7:313
**Bourrier, P.,** *See* Lecarpentier, P., 7:315
*See* Streibl, B., 7:1700
**Bouyssy, A.,** $\Lambda$ and $\Sigma$ hyperons in nuclei, 7:1530 (IPNO-TH—80-49, pp 1-67)
**Bovard, P.,** *See* Philippot, J.C., 7:770
**Bovenko, V.N.,** Some theoretical problems of biological evaluation of medical polymer articles sterilized with radiation, 7:1140 (INIS-mf—5673, pp 47-49)
**Bowen, J.,** Some in cell machines developed for destructive PIE, 7:885
**Bowie, S.H.U.,** Uranium resources, supply and demand, 7:61
**Bowkett, M.W.,** Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**Bowring, R.W.,** MABEL-2. A code to analyze cladding deformation in a loss-of-coolant accident: status, 7:552 (IWGFPT—7, pp 133-137)
**Boyarski, A.M.,** *See* Scharre, D.L., 7:1489
**Boyd, R.E.,** *See* Maddalena, D.J., 7:1167
**Boydell, D.W.,** *See* Simonsen, H.A., 7:156
**Boye-Moeller, K.,** *See* Engelbrektson, A., 7:572
**Bozek, E.,** *See* Beck, F., 7:1592
**Brack, M.,** Fundamentals of the double-humped fission barrier, 7:1613 (IAEA-SMR—43, pp 327-352)
**Bradley, F.J.,** Occupational exposures associated with laser heat sealers, 7:991
**Brais, A.,** *See* Godbout, P., 7:393
**Brandt, P.J.,** *See* Sharland, C.J., 7:773
**Brasz, J.,** Experimental determination of density-wave oscillations in full-scale sodium-heated steam generators, 7:422
**Bratenahl, A.,** Two-level solar dynamo based on solar activity, convection, and differential rotation, 7:1292
**Braunshtein, M.G.,** *See* Zhidovtseva, M.I., 7:1216
**Breidenbach, M.,** *See* Scharre, D.L., 7:1489
**Brenk, H.D.,** Discussion of an environmental dose methodology to obtain compliance with dose limits in the case of postulated accidents, 7:990
**Brennan, J.,** *See* Bedrosian, B., 7:575
**Breth, A.,** *See* Dobrozemsky, R., 7:658
**Brewster, N.E.,** *See* Armstrong, C.W., 7:135
**Briand, C.,** *See* Chauvet-Deroudilhe, M., 7:956
**Briot, F.,** Four observations of surgical treatment of wounds contaminated by radionuclides, 7:1186
**Broecker, W.S.,** *See* Quay, P.D., 7:1028
**Bronin, S.Ya.,** Electron-beam sustained discharge in nitrogen, 7:1462
**Brookins, D.G.,** Alkali and alkaline earth element studies at Oklo, 7:60
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
Geochronologic studies in the Grants mineral belt, 7:138
Syngenetic model for some early Proterozoic uranium deposits. Evidence from Oklo, 7:95
*See* Hicks, R.T., 7:115
*See* Place, J., 7:113
*See* Riese, W.C., 7:119
**Brossard, J.P.,** Drum system CEFE - a new double door transfer system, 7:183
*See* Vertut, J., 7:867
**Brousse, P.,** Plastic frames: Reduction of the kinematical inequality and optimization, 7:1669
**Brown, A.B.,** Carbon deposition on iron and steel surfaces, 7:659
**Brown, J.K.,** Study of chromosome aberration yield in human lymphocytes as an indicator of radiation dose, 7:1170 (INIS-mf—6531, pp vp)
**Brown, K.F.,** *See* Storms, H.A., 7:685
**Brown, M.A.,** Studies of radiation induced hemolysis of erythrocytes, 7:1144 (INIS-mf—6531, pp vp)
**Brown, O.F.,** System of insurance and indemnity coverage for public liability

associated with nuclear materials in the course of transportation in the United States, 7:181 (INIS-mf—6447, pp vp)
**Brown, P.E.,** Modern design for $\alpha$ $\beta$ $\gamma$ active handling facilities for chemical research and development, 7:868
**Bruckner, W.,** $(K^-,\pi^-)$ strangeness exchange reaction on $^6$Li, $^7$Li, and $^9$Be, 7:1579 (TRI—79-1, pp 124-127)
Search for $\Sigma$ hypernuclei by means of the strangeness-exchange reactions $(K^-,\pi^-)$ and $(K^-,\pi^+)$, 7:1582 (TRI—79-1, pp 136-139)
**Bruet, M.,** CONTACT 1 and 2 experiments: behavior of PWR fuel rod up to 15000 MWd.tu$^{-1}$, 7:302 (IWGFPT—7, pp 235-244)
*See* Kauffmann, Y., 7:703
**Brunelle, F.,** *See* Roche, A., 7:1091
**Bruno, J.,** Westinghouse designed distributed mircroprocessor based protection and control system., 7:528 (AECL—7056, pp 101-118)
**Bruzek, A.,** Peculiar type of filament activation, 7:1319
**Bube, R.H.,** Heterojunctions for thin film solar cells, 7:255
**Buchalet, C.B.,** Importance of flux calculations and dosimetry in PWR vessel surveillance programs, 7:290 (EUR—6813(Vol.1), pp 429-436)
**Buck, K.E.,** Structural analysis of non-circular coils for fusion experiments, 7:1693
**Buck, W.W.,** M.I.T. bag model, mass differences, and $q^3\,q^{-3}$ states of hidden colour, 7:1525 (IPNO-TH—80-49, pp 1-8)
**Budding, M.C.,** Reservoir geological model of the Brent Sands in southern Cormorant, 7:39
**Budikova, M.,** *See* Husak, V., 7:1243
**Budinger, T.F.,** *See* Derenzo, S.E., 7:1086
**Buenger, D.E.,** *See* Sullivan, J.P., 7:904
**Buergisser, B.,** Portable $10^4$ curie shielded cell, 7:862
**Buhrman, R.A.,** Composite film selective-absorbers, 7:267
**Bui-Quoc, T.,** *See* Bernard-Connolly, M., 7:661
**Bullough, R.,** Radiation damage in metals, 7:646 (AERE-TP—843, pp 171-181)
**Bunakov, V.E.,** Foundations and models of pre-equilibrium decay, 7:1610 (IAEA-SMR—43, pp 255-282)
**Buncel, E.,** *See* Williams, D.L.H., 7:828
**Buonanno, F.,** *See* Correia, J.A., 7:1087
**Burby, R.J.,** *See* Kaiser, E.J., 7:637
**Burgers, W.F.J.,** *See* Day, G.A., 7:17
**Burgiss, S.,** *See* Hoffman, E.J., 7:1118
**Burkart, K.,** *See* Huebschmann, W.G., 7:567
**Burke, D.L.,** *See* Scharre, D.L., 7:1489
**Burke, M.,** *See* Hoffman, E.J., 7:1118
**Burnhill, T.J.,** Mid-Cretaceous palaeontology and stratigraphy, central North Sea, 7:32
**Burshtein, Sh.A.,** *See* Duma, V.A., 7:1235
*See* Samsonova, L.A., 7:1219
**Burton, P.G.,** Molecular physics and quantum chemistry: into the 80's, 7:1397
**Buschbeck, B.,** Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**Busygina, N.A.,** *See* Zhidovtseva, M.I., 7:1216
**Busza, W.,** Particle production from nuclear targets, 7:1513
**Butler, B.L.,** *See* Claassen, R.S., 7:261
**Butler, M.A.,** Principles of photoelectrochemical, solar energy conversion, 7:252
*See* Ginley, D.S., 7:256
**Butterfield, R.S.,** Assessment of the containment of the UK 250 litre plutonium nitrate package, 7:855 (INIS-mf—6447, pp vp)
**Buttmann, P.,** *See* Stangenberg, F., 7:376
**Butvin, G.K.,** *See* Marega, I.N., 7:1100
**Buyck, W.J.,** Calcination studies on perovskite, zirconolite, barium hollandite and SYNROC-B, 7:675
**Buysse, J.,** *See* Eggermont, G., 7:992

## C

**Cabasino, L.,** *See* Bradley, F.J., 7:991
**Cabrera-Juarez, E.,** Repair and actio spectrum of oxygen-independent lethality of near uv light on Haemophilus influenzae and lack of mutation, 7:1204
**Cahoon, J.L.,** *See* Derenzo, S.E., 7:1086
**Cairns, J. Jr.,** Colonization of artificial substrates by protozoa: replicated samples, 7:1114
**Calf, G.E.,** *See* Airey, P.L., 7:1017
**Caligara, F.,** *See* Blank, H., 7:473
*See* Zamorani, E., 7:187
**Callebaut, D.K.,** Flare model with force-free fields and helical symmetry, 7:1332
**Cambien, R.B.,** Optimized reactor vessel utilizing large forged pieces, 7:309
**Cameron, J.,** History of the evaluation and exploitation of a group of small uranium mines in Portugal, 7:125
*See* Taylor, D.M., 7:64, 7:97
**Cametti, J.,** *See* Zamorani, E., 7:187
**Campagna, A.O.,** *See* Ko, P.L., 7:442
**Campbell, D.,** *See* Brown, P.E., 7:868
**Campbell, D.A.,** Post-irradiation wrapper measurements of irradiated PFR sub-assemblies at Dounreay, 7:410
*See* Higginson, P.R., 7:886
**Campbell, D.W.,** International nuclear trade and non-proliferation issues. Some Canadian views, 7:621
**Campbell, F.R.,** *See* Atchison, R.J., 7:386
**Campbell, T.E.,** *See* Palusamy, S.S., 7:326
**Campion, P.,** Carbon formation processes relevant to advanced carbon dioxide-cooled reactors, 7:357
*See* Blanchard, A., 7:359, 7:362
**Camplan, J.,** Electrostatic scanning of a few mA ion beam. Application to an ion implanter, 7:912
**Canfield, R.C.,** *See* McClymont, A.N., 7:1339
**Cantrell, W.N.,** Bubble concept: an examination of two applications in the utility industry, 7:1000
**Capel, A.C.,** Distributed systems design using separable communications, 7:531 (AECL—7056, pp 141-155)
*See* Shah, R.R., 7:536
**Capitelli, M.,** Non equilibrium dissociation rates of diatomic species. A comparison between numerical and analytical methods, 7:1470
**Caras, I.,** *See* Keren, M., 7:932
**Cardinale, A.,** Basic design requirements for the containment system of a mixed oxide fuel fabrication plant, 7:168
**Cardozo, P.L.,** Combined application of radiology, nuclear medicine and fine needle aspiration biopsy cytology (FNAB), 7:1088
**Carithers, W.C.,** *See* Scharre, D.L., 7:1489
**Carlsen, H.,** Equipment for mechanical piercing and free volume determination, 7:506
*See* Knudsen, P., 7:490
**Carlson, G.A.,** *See* Neef, W.S. Jr., 7:1683
**Carman, G.J.,** Reservoir geology of the Forties oilfield, 7:44
**Carmon, B.,** Decontamination of tritiated water samples prior to tritium assay, 7:775
Relatively fast assay of Sr-90 by measuring the Cherenkov effect from the ingrowing Y-90, 7:774
**Carstens, H.,** Geothermal gradients of the Northern North Sea Basin, 59 to 62°N, 7:24
**Carta, M.,** Propagation experiments in steel-sodium media at TAPIRO, 7:544
**Cartz, L.,** Metamictization by heavy ion bombardment of $\alpha$-quartz, zircon, monazite and nitride structures, 7:719
**Casanova, R.,** X-ray guided biopsy, 7:1096
**Casini, G.,** *See* Biggio, M., 7:1684
**Cassidy, D.J.,** *See* Buyck, W.J., 7:675
**Castello, G.,** *See* Assedo, R., 7:321
**Catton, I.,** *See* Dhir, V.K., 7:282
**Causey, A.R.,** Analysis of pressure tube elongation and end shield interactions in the CANDU reactors, 7:389
**Cebulska-Wasilewska, A.,** *See* Leenhouts, H.P., 7:1200
**Cech, V.,** Design of surface heating of experimental sodium facility at VUHZ Dobra, 7:401 (INIS-mf—6423, pp vp)
*See* Dufek, F., 7:398
**Cepeda, T.,** *See* Santos, J.M., 7:1093
**Cepkauskas, M.M.,** Acoustic pressure pulsations in pressurized water reactors, 7:323
**Cermak, Z.,** Results obtained by efficient nuclear logging methods in brown coal deposit exploration in the North Bohemian Brown Coal Basin, 7:2 (INIS-mf—6422, pp vp)
**Cerman, J.,** Radioiodination of tyrosine analogs of somatostatine: use of QUSO G 32 adsorbent, 7:1059 (INIS-mf—6419, pp vp)
*See* Suba, P., 7:1058
**Cervelli, S.,** *See* Rolston, D.E., 7:1002
**Chaboche, J.L.,** Modelization of the strain memory effect on the cyclic hardening of 316 stainless steel, 7:696
**Chadwick, K.H.,** *See* Leenhouts, H.P., 7:1200
**Chaki, S.K.,** Thermal hydraulic analysis of Rajasthan Nuclear Power Station primary circuits, 7:394
**Chakrabarti, B.K.,** Phonon modes in a disordered lattice, 7:1652
**Chakrabarti, S.K.,** Deformable shell model study of the properties of CsCl, 7:733
**Challinor, A.,** Structural evolution of the North Viking Graben, 7:20
**Chandra, D.,** *See* Growcock, F.B., 7:732
**Chandramouli, S.,** *See* Bhat, I.S., 7:1047
**Chang, C.,** Structure of multiparticles in quark jets, 7:1510
**Chantant, M.,** *See* Atabek, R., 7:305
**Chappell, B.W.,** *See* Ferguson, J., 7:1254

**Charlesworth, D.,** *See* Lloyd, J.W., 7:1024
**Chary, S.L.V.,** *See* Rukmani, K., 7:970
**Chatterjee, P.,** *See* Ray Chaudhury, M., 7:1658
**Chatterjee, S.,** *See* Ray Chaudhury, M., 7:1658
**Chau Wang, L.L.,** *See* Popowicz, Z., 7:1532
**Chaudhuri, B.K.,** *See* Ganguli, S., 7:1650
**Chaumont, J.,** *See* Camplan, J., 7:912
**Chauvet, R.,** *See* Gauthier-Lafaye, F., 7:91
**Chauvet-Deroudilhe, M.,** Detection efficiency of scintillator gels, 7:956
**Chavet, I.,** Universal characteristics of a wedge-type beam for high current electromagnetic isotope separators, 7:908 (IA—1356, pp 293-294)
**Cheeseman, E.W.,** Uranium mining. A review of 1979 developments, 7:151
**Cheissoux, J.L.,** *See* Martin, A., 7:328
**Chen, C.K.,** *See* Wang, S.R., 7:881
**Chen, P.,** Studies of DNA repair and chromosome aberrations in two unusual DNA repair deficient individuals, 7:1149 (INIS-mf—6531, pp vp)
**Chen, S.H.,** *See* Tao, S.J., 7:1431
*See* Tseng, P.K., 7:1432
**Chenier, R.J.,** *See* Mizzan, E., 7:863
**Chenoweth, W.L.,** Exploration in Grants uranium region since 1963, 7:136
**Cherkasov, A.S.,** Evaluation of the molecular ion yield in nuclear fragmentation experiments, 7:1619 (KFTI—79-40, pp 7-9)
Instructiveness of spectra for photodisintegration products of light nuclei, 7:1573 (KFTI—79-48, pp 89-94)
**Cherni, B.P.,** *See* Khorenko, V.K., 7:450
**Chernomorets, S.G.,** *See* Viktorov, A.P., 7:1082
**Cherry, J.A.,** *See* Pickens, J.F., 7:1045
**Cherrywell, C.H.,** *See* Beck, R.G., 7:144
**Chevallard, G.,** Simulation of the dynamic loads and stresses due to explosive rupture of a pressure tube in a scaled down model of the CIRENE reactor structure, 7:390
**Chhatre, A.G.,** Fuel bundle end plate analysis by code SPACE, 7:385
**Chien, C.Y.,** *See* Stroynowski, R., 7:1488
**Chipman, E.G.,** *See* Bohlin, J.D., 7:1364
**Chirigos, J.N.,** *See* Palusamy, S.S., 7:326
**Chistyakov, I.V.,** *See* Zelenkov, A.G., 7:1598
**Chitambar, S.A.,** Isotopic analysis of lithium, boron and magnesium and their importance in nuclear technology, 7:780
**Chitnuyanondh, L.,** *See* Murray, D.W., 7:387
**Chiu, C.B.,** Constraint of color separation on perturbative QCD, 7:1540
**Chiuderi, C.,** Filament instability in a sheared field, 7:1335
**Chopovskaya, T.I.,** *See* Genesina, T.I., 7:1232
**Chopra, V.,** Characteristics of superconducting solenoid with detachable current leads, 7:1659
**Choquard, P.,** Equation of state of one component Coulomb systems, 7:1647 (INIS-mf—6084, pp vp)
**Chou, I.M.,** *See* Clynne, M.A., 7:814
**Chow, J.G.Y.,** *See* Aronson, S., 7:683
**Chrastina, M.,** *See* Cech, V., 7:401
**Christie, W.H.,** Use of indexed sensitivity factors in the analysis of nickel and iron based alloys. A study of the decalibration of sheathed Chromel/Alumel thermocouples, 7:975
**Chrpova, M.,** *See* Dvorak, P., 7:1063, 7:1112
**Chuang, S.Y.,** *See* Tao, S.J., 7:1431
*See* Tseng, P.K., 7:1432
**Chundela, B.,** *See* Hampl, A., 7:1062
**Church, L.B.,** *See* Kathren, R.L., 7:776
**Churier, H.,** *See* Morgand, P., 7:689
**Civelekoglu, Y.,** *See* von Harrach, D., 7:1603
**Claassen, R.S.,** Introduction to Solar Materials Science, 7:261
**Clampitt, R.,** *See* Park, R.M., 7:729
**Clark, D.S.,** Uranium ore rolls in Westwater Canyon sandstone, San Juan Basin, New Mexico, 7:141
**Clark, N.B.,** *See* Rosen, V., 7:1175
**Clark, P.A.,** Recent developments in post-irradiation examination techniques at Harwell, 7:878
**Clark, S.A.,** Nuclear concentration of $^{3}H$-1,25$(OH)_2$ vitamin D3 in cells of pancreatic islets, 7:1071
**Clarke, D.R.,** *See* Harker, A.B., 7:204
**Clarke, T.R.,** Protection of the public and environment, 7:539
**Clay, B.D.,** Measurement and analysis of stress rupture tests on CAGR cladding tubes, 7:164
**Clegg, B.,** Remote sensing of soil radionuclide fluxes in a tropical ecosystem, 7:1007
**Clevinger, G.S.,** *See* Wilson, H.W., 7:476
**Cliff, W.J.,** Morphology and ultrastructure of radiation induced tissue damage in rabbit ear chambers, 7:1161 (INIS-mf—6531, pp vp)
*See* Narayan, K., 7:1160
**Cloninger, M.O.,** Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
**Clottes, G.,** Post-irradiation examination on fast reactor fuel elements in France, 7:409
**Clough, D.J.,** *See* Ainscough, J.B., 7:484
*See* Clark, P.A., 7:878
**Clynne, M.A.,** $SrCl_2$ solubility in complex brines, 7:814
**Cochrane, H.B.,** Monitoring of prestressed concrete pressure vessels for nuclear reactors, 7:449 (IWGHTR—2, pp 183-189)
**Cocke, C.L.,** Recoil charge-state distributions resulting from small impact parameter collisions of F and O projectiles with Ne, 7:1406
**Coehinal, R.,** Use of informatic for radiation control panels, 7:951
**Coendoz, G.,** *See* Walther, R., 7:335
**Cohen, J.J.,** Natural background as an indicator of radiation-induced cancer, 7:1194
**Colby, J.,** Low-level radioactive waste management: charting state issues and responsibilities, 7:613 (NP—2900890)
**Collatz, L.,** Some applications of polynomial and spline approximation, 7:1670
**Colley, M.G.,** Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland, 7:57
**Collier, D.,** Design development and commissioning of two distributed computer based boiler control systems, 7:533 (AECL—7056, pp 168-179)
**Collins, C.H.,** *See* Collins, K.E., 7:652
**Collins, G.A.,** Parametric amplification of Alfven waves, 7:1672 (INIS-mf—6424, pp vp)
**Collins, H.E.,** Emergency planning and preparedness. Pre- and post-Three Mile Island, 7:566
**Collins, K.E.,** In situ studies of transfer annealing in doped crystals of potassium chromate and tris-dipyridylcobalt(III: perchlorate trihydrate, 7:652 (INIS-mf—6450, pp vp)
**Colter, V.S.,** Wytch Farm oil field, Dorset, 7:53
*See* Barr, K.W., 7:49
**Colton, J.D.,** Comparison of potentional crush and impact environments, 7:856 (INIS-mf—6447, pp vp)
**Compston, W.,** *See* Page, R.W., 7:1252
**Conine, W.D.,** Uranium solution mining: comparison of New Mexico with South Texas, 7:155
**Conn, R.W.,** *See* Abdel-Khalik, S.I., 7:1685
**Coons, W.E.,** Basalt waste isolation project data package for reference physicochemical conditions, 7:193
**Cooper, B.A.,** *See* Day, G.A., 7:17
**Cooper, B.S.,** *See* Barnard, P.C., 7:25
**Cooper, C.A.,** *See* Bowring, R.W., 7:552
**Cooper, G.W.,** *See* Abdel-Khalik, S.I., 7:1685
**Cooper, J.A.,** Impact of residential wood combustion on urban air quality: first ambient measurements, 7:982
**Coppi, B.,** Structural analysis of compact experiments for thermonuclear ignition, 7:1694
**Coquerelle, M.,** Evolution of the equipment and recent developments in the alpha, beta, gamma-laboratory of the European Institute for Transuranium Elements, 7:875
**Cordey, J.G.,** *See* Watkins, M.L., 7:1677
**Cordfunke, E.H.P.,** Investigations on caesium uranates: VII. Thermochemical properties of $Cs_2U_4O_{12}$, 7:848
**Cordier, G.,** *See* Chaboche, J.L., 7:696
**Cords, H.,** Irradiation experiment with a large graphite block, 7:737
**Core, W.G.F.,** *See* Watkins, M.L., 7:1677
**Corken, R.J.,** *See* Huffman, A.C. Jr., 7:107
**Cornell, R.M.,** Post-irradiation examination techniques for CAGR fuel, 7:353
*See* O'Keefe, J.M., 7:350
**Cornides, I.,** Investigation of the formation of atomic complexes in the spark ion source by the use of stable isotope tracers, 7:771
**Coroli, G.,** *See* Harriague, S., 7:384
**Correia, J.A.,** Portable device for the measurement of regional cerebral blood flow in the ICU and Or using Cd Te detectors and a fourier transform based data analysis, 7:1087
**Corsetti, L.V.,** Combustion engineering comprehensive fuel inspection stand, 7:876
**Cort, C.E.,** Engineering design of a direct-cycle steam-generating blanket for a long-pulse fusion reactor, 7:1702
**Costa, M.,** *See* Geffroy, J., 7:406
**Costaz, J.L.,** *See* Bordet, R., 7:316

**Cotanch, S.R.,** Neutron density studies through $K^+$-nucleus scattering, 7:1503 (TRI—79-1, pp 92-96)
**Coucill, D.N.,** *See* Baylis, C.C., 7:300
**Cousens, D.R.,** Dissolution of glass during irradiation by $^{60}Co$ γ-rays, 7:727
**Couturier, P.,** Stellar mass flux and coronal heating by shock waves, 7:1304
**Coveart, A.S.,** *See* Osborne, R.V., 7:383
**Cox, B.L.,** The ductility in bending of molybdenum alloys irradiated between 425 and 1000 C, 7:680
**Crabtree, M.,** *See* Hoffman, E.J., 7:1118
**Craighead, H.G.,** *See* Buhrman, R.A., 7:267
**Craik, N.G.,** Design and construction progress on Gentilly 2, Cordoba, Point Lepreau, and Wolsung projects, 7:382
**Craven, S.J.,** *See* Riley, G.H., 7:1261
**Criado, M.,** *See* Serrano, J.R., 7:152
**Cribb, R.J.P.,** Role of PIE in the development of the Magnox fuel element in the UK, 7:342
**Crick, I.H.,** Evaporites and uranium mineralization in the Pine Creek Geosyncline, 7:84
Geology and mineralisation of the South Alligator Valley Uranium Field, 7:70
*See* Needham, R.S., 7:1250
*See* Stuart-Smith, P.G., 7:1251
**Crifo, F.,** Model for the north coronal hole observed at the 1973 eclipse, between 1.3 and 3.2 solar radii, 7:1295
**Crosby, A.,** *See* Fyfe, J.A., 7:31
**Croset, M.,** *See* Barcz, A., 7:772
**Cross, M.T.,** Further developments in the non-destructive examination of irradiated fuel rods at Windscale, 7:512
**Croucher, D.W.,** Behavior of defective pressurized water reactor fuel rods during power ramp and power-cooling-mismatch conditions, 7:560
**Crowley-Milling, M.C.,** Selection case history, minicomputer network control of a large nuclear particle accelerator. Chapter 7.6, 7:915
**Cruikshank, B.I.,** Association of uranium and skarn development in the Mary Kathleen area, Queensland, 7:94
**Csikor, F.,** Confrontation of geometrodynamics with experiment, 7:1548
**Cuillerdier, C.,** Studies of physical properties of plutonium dioxide powders, 7:702 (INIS-mf—6447, pp vp)
**Cullen, T.I.,** Two decades of research in the Brazilian areas of high natural radioactivity, 7:1189
**Cullingford, H.S.,** *See* Cort, C.E., 7:1702
**Cunningham, S.B.,** *See* Jenkins, J.T. Jr., 7:111
**Cuperman, S.,** Physical processes and models of interplanetary responses: suggested theoretical studies, 7:1356
**Curren, W.D.,** Decontamination techniques suitable for post-irradiation examination cases, 7:846
**Currie, L.A.,** *See* Cooper, J.A., 7:982
**Curry, D.A.,** *See* Milne, I., 7:667
**Curtis, I.,** Uranium geology in the Amer-Dubawnt-Yathkyed-Baker Lakes region, Keewatin District, N.W.T. Canada, 7:88
**Cvatkov, V.I.,** *See* Mukhin, I.E., 7:1233
**Cytermann, R.,** Application of microprobe analysis to the determination of cladding steels carburization in fast reactor fuel elements, 7:413
**Czanderna, A.W.,** Surface and interface studies and the stability of solid solar energy materials, 7:642
**Czege, J.,** *See* Keszthelyi, L., 7:844

## D

**D'Escatha, Y.,** *See* Devaux, J.C., 7:691
**D'Uston, C.,** Interplanetary response to solar long time-scale phenomena, 7:1303
**Da Vinha, C.A.G.,** Data management for evaluation of deposits at Nuclebras, 7:126
**Daenner, W.,** First wall and blanket structure performance, 7:1697
FWLTB - a computer program for predicting the lifetime of a fusion reactor first wall, 7:1695
**Dafalias, Y.F.,** Model for soil behavior under monotonic and cyclic loading conditions, 7:1270
**Daly, B.J.,** Model of countercurrent steam-water flow in large horizontal pipes, 7:557
**Dana, J.,** Development of standard series of radiometric probes for ore logging, 7:978 (INIS-mf—6422, pp vp)
**Darai, G.,** *See* Seidel, A., 7:1182
**Darlington, J.,** *See* Baumgartner, S., 7:1152
**Daroczy, S.,** *See* Nagy, S., 7:942
**Das, M.,** Characterisation of sintered $UO_2$ pellets relevant to fuel design and performance, 7:381
*See* Chhatre, A.G., 7:385
**Das, P.K.,** Formation of two photoenols via a common pathway in the photochemistry of 2-methylbenzophenone, 7:833
**Das, S.K.,** *See* Sarkar, S.K., 7:687
**Dass, C.,** *See* Kapoor, S., 7:246, 7:783
**Dassel, G.,** Recent improvements in facilities for gamma-scanning and other non-destructive examinations of irradiated materials at ECN's hot cell plant L.S.O., 7:873
**Davis, D.D.,** Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**Davis, I.,** Data management problems with a distributed computer network on nuclear power stations, 7:529 (AECL—7056, pp 119-128)
**Davis, T.,** *See* Cribb, R.J.P., 7:342
**Davydova, L.I.,** Effective renal blod flow and canalicular function of kidneys with obliterating endarteritis, 7:1104
**Dawson, J.T.,** Experience gained in the accurate measurement of fission product distributions by axial fuel pin gamma scanning, 7:513
**Dawson, W.K.,** CAMAC system test module, 7:1709
**Day, G.A.,** Regional seismic structure maps of the North Sea, 7:17
**De'Ath, N.G.,** Geology of the Magnus oilfield, 7:41
**de Boodt, M.,** Isotope versus the total balance method to assess nutrient losses and erosion risks, 7:1122 (IAEA-TECDOC—236, pp 44-51)
**De Carli, A.,** *See* Carta, M., 7:544
**de Charpal, O.,** *See* Roberts, D.G., 7:51
**De Jesus F, M.,** *See* Collins, K.E., 7:652
**De Leeuw, S.,** Si reactor damage monitors and their application, 7:444 (EUR—6813(Vol.1), pp 93-107)
**de Leeuw-Gierts, G.,** Report on session L - Workshop on dosimetry techniques, 7:927 (EUR—6813(Vol.2), pp 1089-1090)
Review of session L: dosimetry techniques, 7:925 (EUR—6813(Vol.2), pp 950-958)
**de Meulemeester, E.,** Effects of uncertainties of experimental data in the benchmarking of a computer code, 7:488 (IWGFPT—7, pp 276-282)
**de Paz, J.F.,** Thermal analysis of a high-temperature falling bed fusion reactor blanket, 7:1687
**de Regge, P.,** *See* van Asbroeck, P., 7:291
**de Voogt, H.J.,** *See* Schroeder, F.H., 7:1099
**de Wouters, R.,** *See* Knipe, A.D., 7:395
**Dean, P.N.,** Simplified method of DNA distribution analysis, 7:1068
**Dearnaley, G.,** Design criteria for ion implantation equipment for surface treatment, 7:676
**Debru, M.,** *See* Schneider, J.C., 7:425
**Debrue, J.,** *See* Mathieu, F., 7:929
**Dedonder, J.P.,** Unitarity constraints in the construction of 'optical potential' operators, 7:1635 (IPNO-TH—80-49, pp 1-25)
**DeFur, D.D.,** IHX design for pool type LMFBR system application, 7:417
*See* Spring, A.H., 7:418
**Degaonkar, S.S.,** Thermalisation of flare-time energetic electrons observed at radio and X-ray wavelengths, 7:1323
*See* Sawant, H.S., 7:1330
**Dehon, C.,** Analytical interpretation of PCI related experiments, 7:306 (IWGFPT—8, pp 142-149)
**Deineko, A.S.,** *See* Malakhov, I.Ya., 7:1620
*See* Ustimenkov, K.F., 7:1618
**Dejneko, A.S.,** Low-energy α-particle spectrometer for elastic scattering studies, 7:935 (KFTI—79-40, pp 19-22)
**del Re Brun, R.M.G.,** New device for isometric localization of nonpalpable breast lesions detected by mammography. Experience in over 100 cases, 7:1097
**Delcon, M.,** *See* Mathieu, F., 7:929
**Delevallee, A.,** *See* Zecevic, V., 7:877
**Dell'Amico, M.,** *See* Chauvet-Deroudilhe, M., 7:956
**Della Valle, R.S.,** *See* Hicks, R.T., 7:115
*See* Place, J., 7:113
*See* Riese, W.C., 7:119
**Deluca, H.F.,** *See* Clark, S.A., 7:1071
**Demant, J.T.,** *See* Clark, P.A., 7:878
**Demeester, J.,** *See* de Meulemeester, E., 7:488
**Dementii, S.V.,** Exchange internucleon interactions in deep inelastic electron scattering by nuclei, 7:1565 (KFTI—79-48, pp 87-88)
**Demildt, A.C.,** *See* Van de Velde, J., 7:883

**Demirkhanov, R.A.,** Partially ionized gas in a travelling high frequency magnetic field, 7:1461
**Depierre, Y.,** *See* Bon Mardion, G., 7:427
**Derenzo, S.E.,** Imaging properties of a positron tomography with 280 bgo crystals, 7:1086
**Derewlany, L.O.,** *See* McKercher, H.G., 7:1079
**Derrick, G.M.,** *See* Cruikshank, B.I., 7:94
**Descroix, E.,** *See* Bedjidian, M., 7:1581
**Desrosiers, A.E.,** *See* Kathren, R.L., 7:776
**Deutscher, R.L.,** Ground water geochemistry in the vicinity of the Jabiluka deposits, 7:99
**Devan, J.H.,** *See* Keiser, J.R., 7:678
**Devaux, J.C.,** Criterion for analysing fatigue crack initiation in geometrical singularities, 7:691
**Devine, W.D. Jr.,** *See* Reister, D.B., 7:611
**DeVoto, R.H.,** Use of helium in uranium exploration, Grants district, 7:149
**Dewanckel, B.,** *See* Bon Mardion, G., 7:427
**Dharmadurai, G.,** Hotspot induced anomalies and hysteresis in long superconducting Ag-Sn proximity-effect bridges, 7:1656
Phonon-injection-induced nonequilibrium phenomena in superconducting proximity-effect bridges, 7:1657
*See* Chopra, V., 7:1659
**Dhir, V.K.,** Study of transient air injection into a pool of water, 7:282
**Dias de Deus, J.,** Quarks and hadrons: structure functions and fragmentation functions, 7:1534
**Dicke, G.J.,** Risk assessment applied to transportation of tritiated heavy water, 7:243 (INIS-mf—6447, pp vp)
**Dickson, B.L.,** Movements of uranium and daughter isotopes in the Koongarra uranium deposit, 7:82
**Dilonardo, M.,** *See* Capitelli, M., 7:1470
**Dincer, T.,** Use of environmental isotopes in arid zone hydrology, 7:1012
*See* Sonntag, C., 7:1016
**Dingwall, R.G.,** *See* Johnson, R.J., 7:18
**Dirckze, C.D.,** Effect of bacteriophage C5 on ultraviolet survival in Pseudomonas aeruginosa, 7:1156 (INIS-mf—6531, pp vp)
**Dixon, J.E.,** Tectonic significance of post-Carboniferous igneous activity in the North Sea Basin, 7:22
**Djakov, B.E.,** *See* Hermoch, V., 7:1455
**Dmitriev, I.M.,** *See* Dmitrieva, G.A., 7:1083
*See* Genesina, T.I., 7:1232
**Dmitrieva, Eh.A.,** *See* Studenikina, F.G., 7:1138
**Dmitrieva, G.A.,** Iodine-131 application in studying mechanism of Morshin mineral water effect, 7:1083
**Dobias, M.,** *See* Mucha, J., 7:1060
**Dobremelle, M.,** *See* Geffroy, J., 7:406
**Dobrovol'skaya, G.F.,** *See* Studenikina, F.G., 7:1138
**Dobrowolny, M.,** Properties of magnetohydrodynamic turbulence in the solar wind, 7:1308
**Dobrozemsky, R.,** Radiation-enhanced permeation of $H_2$ in stainless steel, 7:658
**Docekal, J.,** Sodium sampling and impurities determination, 7:741 (INIS-mf—6423, pp vp)
**Dodd, T.,** *See* Barrett, T.R., 7:866
**Dodelier, J.,** *See* Bruet, M., 7:302
*See* Dehon, C., 7:306
**Doi, K.,** Geoscientific evaluation of radioactive waste isolation in Japan, 7:198
**Doke, T.,** Application of solid state track detector to detect heavy primary cosmic ray, 7:936 (KURRI-TR—190, pp 1-6)
Possibility of isotope separation in primary cosmic ray using plastic films, 7:962
**Dolbilkin, B.S.,** Cross section of electron elastic scattering with $^{12}C$ nucleus as a reference standard for relative measurements, 7:1578 (KFTI—80-6, pp 39-42)
**Dolenko, A.V.,** *See* Shamov, A.I., 7:769
**Domanus, J.C.,** Need for standardization in the field of neutron radiography, 7:943
**Domaratzki, Z.,** Reactor safety requirements in times of change, 7:568
**Domoto, K.,** Semi-empirical evaluation studies on PCMI for the Fugen fuel rod, 7:551 (IWGFPT—7, pp 44-55)
**Donagi, A.,** *See* Kuszpet, M.E., 7:959
*See* Tadmor, J., 7:632
**Donato, J.A.,** Regional interpretation of North Sea gravity data, 7:16
**Donbrow, M.,** *See* Shani, J., 7:1199
**Donnelly, T.H.,** Stable isotope study of three deposits in the Alligator Rivers Uranium Field, N.T., 7:77
*See* Ferguson, J., 7:86
**Donnerhacke, K.H.,** Theoretical and experimental investigations of the electrical excitation rates in TEA-$CO_2$-lasers, 7:890
**Donten, K.,** Results of strength tests on a 1:10 model of reactor containment, 7:317
**Dorman, L.I.,** Energy exchange between cosmic rays and the solar wind, 7:1281 (INIS-mf—6385, pp 123)
**Doroshenko, A.N.,** *See* Demirkhanov, R.A., 7:1461
**Dorre, P.,** Quasiparticle and excitation energies of a condensed model bose system, 7:1441 (INIS-mf—6084, pp vp)
**Douglin, J.J.,** Trends in public opinion. . The Ontario case, 7:626
**Douillet, M.G.,** EDF's (Electricite de France) in service control for GCR type reactor vessels, 7:339 (IWGHTR—2, pp 176-183)
**Dousson, S.,** Electron cyclotron resonance source for heavy multiply charged ions, 7:1390
**Dover, C.B.,** Nuclear physics with kaons, 7:1484 (TRI—79-1, pp 4-11)
**Dowling, N.E.,** Analysis of notch strain for cyclic loading, 7:699
**Doyen, J.J.,** *See* Bethmont, M., 7:327
*See* Prost, J.P., 7:322
**Doyon, D.,** *See* Roche, A., 7:1089, 7:1091
**Dray, M.,** *See* Salem, O., 7:1021
**Dreesen, K.,** *See* Heinzelmann, M.F.M., 7:958
**Dreschhoff, G.A.M.,** *See* Zeller, E.J., 7:127
**Driver, E.T.,** Evaluating dangerous goods emergency response with time/loss analyses, 7:858 (INIS-mf—6447, pp vp)
**Dryer, M.,** *See* Maxwell, A., 7:1329
*See* Tanaka, K., 7:1325
**du Breuil, F.,** *See* Kost, J.A., 7:4
**Dubik, V.T.,** *See* Yasinova, A.A., 7:1220
**Dubnicka, S.,** Pion form factor as a Pade type approximation in the conformally mapped variable, 7:1524
**Ducas, S.,** *See* Vignesoult, N., 7:507
**Duckworth, F.C.,** *See* Cribb, R.J.P., 7:342
**Dufek, F.,** Equipment for long-term testing of material creep in liquid sodium, 7:398 (INIS-mf—6423, pp vp)
*See* Cech, V., 7:401
**Duff, C.G.,** *See* Aziz, T.S., 7:392, 7:594
**Duftschmid, K.E.,** Secondary standard dosimetry system with automatic dose/rate calculation, 7:952
**Duijveman, A.,** *See* Hoyng, P., 7:1336
**Dukhan, R.,** Radioactive fallout in Israel 1976-1978, 7:986 (IA—1356, pp 288)
**Dulk, G.A.,** *See* Jackson, B.V., 7:1346
*See* Sheridan, K.V., 7:1294
**Duma, V.A.,** Dynamics of hematologic indices in patients with breast cancer in megavolt gamma therapy, 7:1235
*See* Zhidovtseva, M.I., 7:1240
**Dun, D.L.,** *See* Fenkel', L.A., 7:1207
**Dunbier, J.,** *See* Pedersen, C.P., 7:131
**Duncan, E.A.,** *See* Bassett, R.L., 7:195
**Duncan, R.A.,** Recent very bright type IV solar metre-wave radio emissions, 7:1347
**Dunn, J.J.,** Transcription termination at the end of the early region of bacteriophage T7 DNA, 7:1070
**Dunwoodie, W.,** *See* Stroynowski, R., 7:1488
**Duplishcheva, A.P.,** *See* Tumanyan, M.A., 7:1139
**Dustmann, C.H.,** *See* Arendt, F., 7:1691
**Duvidzon, V.M.,** Gas discharge investigation in crossed electric and magnetic fields, 7:1458
**Duwe, R.,** Investigation of the activity release from HTR fuel element spheres during storage, 7:355
**Dvorak, D.,** Possibility of determining rock massif stress by isotope methods, 7:1266 (INIS-mf—6422, pp vp)
*See* Keclik, L., 7:1267
**Dvorak, P.,** Czechoslovak-made testosterone RIA kit, 7:1063 (INIS-mf—6419, pp vp)
Testosterone concentration in mother's serum and in amniotic fluid, 7:1112 (INIS-mf—6419, pp vp)
**Dyer, A.,** Gas chemistry in nuclear reactors and large industrial plant, 7:842
**Dynnik, M.S.,** Radiation hygiene working conditions and health state of the personnel dealing with sealed radioactive materials, 7:1234
*See* Samsonova, L.A., 7:1219
*See* Zhidovtseva, M.I., 7:1216, 7:1240
**Dzhapishvili, T.V.,** *See* Alaniya, M.V., 7:1282
**Dzhibuti, R.I.,** Complete photodisintegration of three- and four-particle nuclei, 7:1563 (KFTI—79-48, pp 38-42)
Role of meson currents in the complete photodisintegration of $^4He$ nucleus, 7:1562 (KFTI—79-48, pp 36-37)
**Dzyubak, A.D.,** *See* Dzyubak, S.T., 7:1121
**Dzyubak, S.T.,** Permeability state of microcirculatory channel of some organs in rabbits under conditions of pyocyanic infections process, 7:1121

## E

**Eadie, D.Mc.D.,** Multicavity PCPVs for HTR and GCFR systems, 7:336 (IWGHTR—2, pp 51-57)
**Earnest, D.F.,** *See* Beck, R.G., 7:144
**Ebbern, J.,** Geology of the Morecambe gas field, 7:56
**Eberhardt, P.,** *See* Kopp, E., 7:1374
**Ebert, W.,** Energy balance of noble gas ion laser discharges, 7:900
**Eckhardt, G.,** Current densities in anchored cathode spots of a dc mercury vacuum arc, 7:1452
**Edenhofer, P.,** *See* Porsche, H., 7:1365
**Edge, T.,** *See* Cribb, R.J.P., 7:342
**Edmonds, E.,** Operating experience in the new irradiated fuel handling and examination cave at the Prototype Fast Reactor, Dounreay, 7:408
**Edmunds, W.M.,** Geochemical and isotopic approach to recharge evaluation in semi-arid zones: past and present, 7:1014
**Edneral, V.F.,** Analysis of elastic scattering in the method of the generalized matrix of reactions, 7:1481 (JINR-D—2-11707, pp 435-463)
**Efimova, A.S.,** *See* Beletskii, V.I., 7:1238
**Eggermont, G.,** Study and measurement of the atmospheric pollution by $^{85}$Kr, 7:992
**Egiasarov, B.G.,** *See* Shamov, A.I., 7:769
**Ehlers, K.W.,** *See* Leung, K.N., 7:911
**Ehstulin, I.V.,** *See* Val'nichek, B.I., 7:1286
**Eilam, Y.,** Corticosteroid-induced changes in fluxes and in intracellular distribution of calcium in cultured bone cells, 7:1074
**Eisenbud, M.,** *See* Cullen, T.L., 7:1189
**Eisenhauer, C.M.,** Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2), pp 919-927)
**Eisenstein, R.A.,** Kaon elastic and inelastic scattering at 800 MeV/c, 7:1483 (TRI—79-1, pp 75-81)
**Eisner, A.,** *See* Tadmor, J., 7:981
**Ekbote, S.N.,** *See* Bhide, V.G., 7:1660
**Ekhichev, O.I.,** *See* Antuf'ev, Yu.P., 7:742
*See* Gorenko, A.F., 7:743
**El-Karouri, M.O.H.,** Effect of desertification and soil salinity on land productivity in the Sudan, 7:1127 (IAEA-TECDOC—236, pp 115-139)
**El-Kholi, A.F.,** Some aspects in relation to the efficient use of soils, water and fertilizers in Egypt, 7:1126 (IAEA-TECDOC—236, pp 95-106)
**Elaev, V.F.,** Experimental investigation of the pulse discharge in Cu + Ne mixture in high repetition rate regime, 7:894
**Elbaz, E.,** Leptons, quarks and hadrons in a same theoretical approach, 7:1527 (IPNO-TH—80-49, pp 1-4)
**Eldrup, M.,** *See* Levay, B., 7:1435
**Elfmann, W.,** Nonlinear, dynamic, plastic component-support analysis, 7:329
**Elgat, Z.,** *See* Admon, U., 7:974
**Eliah, Y.,** *See* Carmon, B., 7:774, 7:775
**Eliasson, L.,** Some results from the auroral particle experiment on board the barium-GEOS rocket, 7:1377 (ESA-SP—152, pp 263-268)
*See* Sandahl, I., 7:1376
**Eliseev, A.N.,** *See* Belousov, A.S., 7:1576
**Ellis, R.G.,** Electromagnetic decay widths for L=1 Jsup(PC) = $1^{--}$ T-baryonia, 7:1508
**Emmerson, B.W.,** Review from the regulatory position of the control of occupational exposure associated with the first 20 years of the United Kingdom commercial nuclear power programme, 7:631
**Emsley, A.M.,** *See* Brown, A.B., 7:659
**Emtage, P.R.,** Interaction of vacuum arcs with transverse magnetic fields, 7:1453
**Enami, T.,** *See* Ohashi, N., 7:668
**Enderle, G.,** *See* Schumann, U., 7:579
**Endo, I.,** Measurement of $K^{+-}$-nucleus elastic scattering at forward angles. An experiment to be done at KEK, 7:1485 (TRI—79-1, pp 101-104)
**Enever, J.R.,** *See* McKavanagh, B.M., 7:5
**Engel, J.J.,** *See* Zarka, J., 7:464
**Engeland, T.,** Alternative formulation of the particle-rotor model, 7:1637 (OUP—81-09, pp 46-49)
Particle-rotor model analysis of $^{163}$Er, 7:1594 (OUP—81-09, pp 52-54)
*See* Henriquez, A., 7:1593
**Engelbrektson, A.,** Performance of Scandinavian BWR-containments during pressure tests, 7:572
**Engelhardt, W.,** *See* Backe, H., 7:1411
**Engels, J.,** *See* Baier, R., 7:1542
**Enghardt, W.,** CAMAC-monitor for MPS 4944 and SDK-80 microcomputers, 7:1707 (ZfK—410, pp 189-191)
**Engvold, O.,** Energy and mass injected by flares and eruptive prominences, 7:1315
**Ennis, P.J.,** High temperature alloys for the primary circuit of a prototype nuclear process heat plant, 7:380
**Enoch, J.M.,** *See* Fitzgerald, C.R., 7:1172
**Entine, G.,** *See* Correia, J.A., 7:1087
**Eponeshnikov, V.N.,** Study of the ($\gamma$, $\pi^0$p) reaction of $^6$Li, $^{12}$C and $^{16}$O nuclei in a wide range of transferred momentum, 7:1574 (KFTI—80-6, pp 12-13)
**Epstein, A.,** *See* Assedo, R., 7:321, 7:538
**Epstein, G.N.,** Kaon-nucleus interactions in the Λ(1520) region, 7:1504 (TRI—79-1, pp 97-100)
**Erb, J.,** Finite element structural analysis of coil and casing of a large superconducting toroidal LCT-magnet, 7:1690
Method for determining the magnet shape in toroidal arrangements, 7:1692
**Erbacher, F.J.,** *See* Rosinger, H.E., 7:550
**Erben, O.,** Properties and application of self-powered neutron detectors, 7:928 (EUR—6813(Vol.2), pp 1145-1151)
**Erdei, K.,** *See* Nagy, S., 7:942
**Eremias, B.,** *See* Fresl, M., 7:648
**Erents, S.K.,** Experimental results from the DITE bundle divertor, 7:1678
**Ericson, J.E.,** Durability of rhyolitic obsidian glass inferred from hydration dating research, 7:714
**Esteves, R.G.,** Model for simulating non-equilibrium fission gas behaviour, 7:478 (IWGFPT—7, pp 124-132)
**Estiot, J.C.,** SAMPO: a code system giving different orders of approximation for sensitivity and perturbation analysis, 7:451
**Ethridge, F.G.,** Effects of ground-water flow on the origin of Colorado Plateau-type uranium deposits, 7:105
**Ettouney, M.,** *See* Bedrosian, B., 7:575
**Eupene, G.S.,** *See* Hegge, M.R., 7:69
**Evans, J.H.,** *See* Clark, P.A., 7:878
**Ewers, G.R.,** Mineralogy of the Jabiluka, Ranger, Koongarra and Nabarlek uranium deposits, 7:75
*See* Ferguson, J., 7:86
**Ewing, R.C.,** *See* Malow, G., 7:715
**Exler, H.J.,** Groundwater pollution considered as a continuous injection of tracers, 7:1035
**Eyni, M.,** Empirical relation between density, flow velocity and heliocentric distance in the solar wind, 7:1309
*See* Steinitz, R., 7:1310
**Eynon, G.,** Basin development and sedimentation in the Middle Jurassic of the northern North Sea, 7:28

## F

**Fabry, A.,** *See* De Leeuw, S., 7:444
*See* McGarry, E.D., 7:926
**Facchini, A.G.,** Considerations on a sol-gel type process as a fuel fabrication route for the actinide recycle, 7:163 (EUR—6929, pp 331-348)
**Faelth, L.,** *See* Forberg, S., 7:209
**Faessler, A.,** Bruckner-Hartree-Fock as a starting point for the description of excited states in nuclei, 7:1583
Selfconsistent description of nuclei, 7:1629
**Faessler, M.A.,** *See* Bruckner, W., 7:1579, 7:1582
**Faggioni, F.,** *See* Ubertini, P., 7:948
**Fahr, H.J.,** Observation of dust generated hydrogen in the solar vicinity, 7:1311
*See* Petelski, E.F., 7:1312
**Fain, E.A.,** *See* Kogan, I.A., 7:1217
**Faircloth, R.L.,** Calculation of methane profiles in graphite structures, 7:722
Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
*See* Bennett, M.J., 7:358
**Fajszi, Cs.,** *See* Keszthelyi, L., 7:844
**Falconer, J.W.,** Some gaseous reactions in carbon dioxide based coolants, 7:832
**Falkowski, S.K.,** Geology and ore deposits of Johnny M mine, Ambrosia Lake District, 7:118
**Fallick, A.E.,** Instrumental effects in the application of static mass spectrometry to high-sensitivity carbon isotope measurements, 7:764
**Famiglietti, M.,** *See* Chevallard, G., 7:390
**Farfaletti-Casali, F.,** *See* Biggio, M., 7:1684
**Farley, M.,** *See* Ryding, G., 7:1388
**Farmer, F.R.,** Reactor safety, analysis and prognosis, 7:559
**Farthing, J.W.,** *See* Bath, L.J., 7:154
**Farwell, S.O.,** *See* Adams, D.F., 7:1005
**Faure, J.C.,** *See* Marcaillou, J., 7:191
**Faure, M.,** *See* Alberman, A., 7:289
**Fedorov, N.F.,** *See* Aksenov, M.S., 7:1444
**Fedorov, V.F.,** *See* Elaev, V.F., 7:894
**Fedorov, Yu.A.,** *See* Genesina, T.I., 7:1232
**Fedorov, Yu.I.,** *See* Dorman, L.I., 7:1281
**Fedorova, L.I.,** *See* Blokh, K.O., 7:1222
**Fee, E.J.,** *See* Quay, P.D., 7:1028

**Fei, Q.,** Present exploration status of the Lianshanguan uranium deposit, Northeast China, 7:134
**Feirn, W.C.,** *See* Beck, R.G., 7:144
**Fenkel', L.A.,** Study on bone tissue diffraction picture of irradiated rats of different age, 7:1207
**Fenyi, S.,** Calculability of multiple chemical interactions, 7:818
**Ferentchak, J.A.,** *See* Ethridge, F.G., 7:105
**Ferguson, J.,** Granitoids in the Pine Creek Geosyncline, 7:1254
Metamorphism in the Pine Creek Geosyncline and its bearing on stratigraphic correlations, 7:1255
Model for the development of economic uranium mineralization in the Alligator Rivers Uranium Field, 7:86
Pine Creek Geosyncline. Statistical treatment of whole rock chemical data, 7:67
*See* Cruikshank, B.I., 7:94
*See* Donnelly, T.H., 7:77
*See* Ewers, G.R., 7:75
*See* Rossiter, A.G., 7:1258
**Feshchenko, Z.P.,** *See* Kiselevskii, L.I., 7:1464
**Festag, J.G.,** Dose rates during experiments with heavy ions, 7:919
**Fetisov, I.K.,** *See* Duvidzon, V.M., 7:1458
*See* Tyuryukanov, P.M., 7:1459
**Fetisov, Y.K.,** *See* Tyuryukanov, P.M., 7:1460
**Fiche, C.,** *See* Bosser, R., 7:236
**Fici, J.A.,** Pressurized water reactor fuel duty during core operation, 7:304 (IWGFPT—8, pp 85-91)
**Fieguth, T.,** *See* Stroynowski, R., 7:1488
**Field, J.J.,** *See* Watkins, M.L., 7:1677
**Fielding, S.J.,** *See* Erents, S.K., 7:1678
**Fignerova, H.,** Importance of HCG determination for the diagnosis of extrauterine pregnancy, 7:1109 (INIS-mf—6419, pp vp)
**Filippov, S.S.,** Inversion of the atomic level population densities in low temperature alkali plasma, 7:897
**Finch, W.I.,** Research on interactive genetic-geological models to evaluate favourability for undiscovered uranium resources, 7:130
**Findlay, J.R.,** *See* Brown, P.E., 7:868
**Fingerova, H.,** Alphaphetoprotein RIA without purchases of kits, 7:1066 (INIS-mf—6419, pp vp)
**Finkel, M.P.,** *See* Mays, C.W., 7:1185
**Finlay, C.J.,** *See* McAndrew, J., 7:74
**Finstad, K.G.,** *See* Carstens, H., 7:24
**Firth, R.J.,** *See* Bennett, M.J., 7:358
**Fisher, M.J.,** *See* Hancock, N.J., 7:27
**Fitch, D.C.,** Exploration for uranium deposits. Grants mineral belt, 7:137
**Fitch, F.J.,** *See* Frost, R.T.C., 7:15
**Fitton, J.G.,** *See* Dixon, J.E., 7:22
**Fitzgerald, C.R.,** Kinetic perimetry (in the plateau region of the field) as a sensitive indicator of visual fatigue or saturation-like defects in retrobulbar anomalies, 7:1172
**Fitzrandolph, L.,** *See* Bradley, F.J., 7:991
**Fivejskii, E.V.,** *See* Zagryazkin, V.N., 7:852
**Flaks, I.P.,** *See* Ogurtsov, G.N., 7:1425
**Fleischer, R.L.,** Nuclear track production in solids, 7:711
Radon emanation over an orebody: search for long-distance transport of radon, 7:150
**Flicker, H.,** *See* McDowell, R.S., 7:829
**Floran, R.J.,** Geologic stability of monazite and its bearing on the immobilization of actinide wastes, 7:720
**Florek, S.,** *See* Ross, W., 7:891
**Flothmann, D.,** *See* Hartwig, S., 7:176
**Flotow, H.E.,** Heat capacity from 5 to 350 K and thermodynamic properties of cesium nitrate to 725 K, 7:813
**Flueckiger, U.,** Comparison between alpha autoradiography and some measured alpha emitting actinide profiles in a (UPu)C sphere-pac fuel, 7:517
*See* Bart, G., 7:945
**Fluegel, R.M.,** *See* Seidel, A., 7:1182
**Fogelman, I.,** *See* Lindsay, R., 7:1076
**Fomenko, A.I.,** *See* Belousov, A.S., 7:1576
**Fontes, J.C.,** Environmental isotope study of groundwater systems in the Republic of Djibouti, 7:1026
**Foote, B.L.,** *See* Gonen, T., 7:275
**Forberg, S.,** Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209
**Ford, M.,** DNA replication and repair in human cells exposed to ionizing radiation, 7:1245 (INIS-mf—6531, pp vp)
**Forgie, S.H.,** *See* Aird, H.M., 7:370
**Foster, E.,** Post-irradiation chemical analysis of irradiated nuclear fuels, 7:509
**Foster, J.F.,** Anomalous orebody within the Ambrosia Lake trend at Sandstone Mine, 7:142
**Foult, T.,** *See* Prost, J.P., 7:322
*See* Streibl, B., 7:1700
**Fournelle, R.A.,** *See* Cartz, L., 7:719
**Fox, M.A.,** Photoexcited states of organic anions, 7:834
**Fox, W.E.,** *See* Cort, C.E., 7:1702
**Franca, E.P.,** *See* Cullen, T.L., 7:1189
**Francke, K.P.,** Eddy-current testing as a tool for post-irradiation examination, 7:508
**Frankel', L.A.,** Ionizing radiation effect on calcitonin production system in rats of various ages, 7:1230
**Franzen, J.,** *See* Larwill, M., 7:914
**Fraser, A.S.,** Evaluation of void swelling in irradiated L.M.F.B.R. components by density measurement, 7:414
**Fraser, W.J.,** Geology and exploration of the Rum Jungle Uranium Field, 7:71
*See* Berkman, D.A., 7:73
**Frazer, W.R.,** Tests of QCD in two-photon collisions, 7:1546
**Freidt, J.M.,** *See* Collins, K.E., 7:652
**Freiesleben, H.,** *See* von Harrach, D., 7:1603
**Freisinger, J.,** Experimental determination of the stable working region of a 15 cm-diameter RF-ion source 'RIT 15', 7:1438
**Frenkel', L.A.,** *See* Shantyr', V.I., 7:1211
**Frenzel, P.F.,** *See* Lyford, F.P., 7:234
**Fresl, M.,** Effect of liquid sodium on behaviour of selected structural materials for steam generators of fast power reactors, 7:648 (INIS-mf—6423, pp vp)
*See* Kneifl, M., 7:650
*See* Pitak, O., 7:405
**Frey, N.D.,** *See* Jaske, C.E., 7:662
**Friedlander, M.,** *See* Aronson, S., 7:683
**Frisch, W.,** *See* Natzle, W.C., 7:830
**Frittelli, L.,** Application of cost-effectiveness analysis to restrict the damage caused by accidental release of radioactive material to the environment, 7:570
**Fritz, K.,** *See* Nemet, J., 7:337
**Fritz, P.,** *See* Lloyd, J.W., 7:1024
*See* Salati, E., 7:1019
**Froehner, F.H.,** Applied neutron resonance theory, 7:1604 (IAEA-SMR—43, pp 59-95)
**Frost, R.T.C.,** Age and nature of the crystalline basement of the North Sea Basin, 7:15
*See* Dixon, J.E., 7:22
**Fudge, A.J.,** *See* Brown, P.E., 7:868
**Fuger, J.,** Aqueous actinide complexes. A thermochemical assessment, 7:847
**Fujii, K.,** Distributed control and data processing system with a centralized database for a BWR power plant, 7:526 (AECL—7056, pp 43-64)
Use of distributed micro processors for sodium pre-heating system, 7:530 (AECL—7056, pp 129-140)
*See* Sasaki, Y., 7:731
**Fujimoto, F.,** *See* Kawatsura, K., 7:1403
**Fujita, F.,** *See* Narita, M., 7:937
**Fujita, K.,** *See* Igarashi, T., 7:597
*See* Shiraki, K., 7:591
**Fujita, T.,** *See* Imai, Y., 7:1174
**Fukami, T.,** *See* Imai, Y., 7:1174
**Fukasako, N.,** *See* Murase, H., 7:682
**Fukase, M.,** *See* Imai, Y., 7:1174
**Fukuda, S.,** *See* Nagakura, T., 7:174
*See* Narita, O., 7:993
*See* Shinohara, K., 7:953
**Fukuhara, A.,** *See* Susukida, H., 7:665
**Fukuzawa, F.,** Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
**Fuller, P.G.,** *See* Walton, R.J., 7:9
**Fulop, M.,** Contribution to neutron dosimetry at the synchrocyclotron at the Joint Institute for Nuclear Research, Dubna, 7:907
**Fulton, E.J.,** *See* Fraser, A.S., 7:414
**Furmanski, W.,** QCD tests: 3G vertex effects, 7:1547
**Furnica, G.,** Chemical behaviour and ecological transfer in the human food chain of some radionuclides in aqueous ecosystems, 7:1043 (IAEA-TECDOC—229, pp 127-148)
*See* Nistor, O., 7:1044
**Furrer, H.,** *See* Mueller, C., 7:573
**Fursaev, A.V.,** Influence of dynamic correlations and of nuclear structure effects on the form factors of excitation of light nuclei by fast electrons, 7:1571 (KFTI—79-48, pp 30-33)
**Fursey, G.N.,** *See* Aksenov, M.S., 7:1444
*See* Vorontsov-Veliaminov, P.N., 7:1474
**Furuichi, K.,** *See* Kohata, Y., 7:424
**Fuzikawa, K.,** *See* Ypma, P.J.M., 7:76
**Fyfe, J.A.,** Subcrop of the Mid-Mesozoic unconformity in the UK area, 7:31
**Fyfe, W.S.,** *See* Karkhanis, S.N., 7:202
*See* Nesbitt, H.W., 7:203

## G

**Gabay, Y.,** *See* Keren, M., 7:932

**Gabuniya, R.I.,** Radioisotope diagnosis in vitro in clinical examinations. Chapter 10, 7:1101
**Gadsby, G.R.,** *See* Keep, C.W., 7:825
**Gainova, L.E.,** *See* Aitbaev, F.B., 7:1277
**Gaisenyuk, L.A.,** *See* Samsonova, L.A., 7:1219
**Gaizauskas, V.,** Location of compact microwave sources with respect to concentrations of magnetic field in active solar regions, 7:1293
**Gajsenyuk, L.A.,** *See* Dynnik, M.S., 7:1234
**Galbraith, H.W.,** *See* McDowell, R.S., 7:829
**Gale, N.H.,** *See* Hart, R.J., 7:1274
**Gales, S.,** Inner shells in heavy nuclei, 7:1636 (IPNO-TH—80-49, pp 1-19)
**Gallagher, S.A.,** *See* Schulz, W.W., 7:199
**Gallego, J.,** *See* Santos, J.M., 7:1093
**Gallone, S.,** *See* Facchini, A.G., 7:163
**Galloway, W.E.,** Deposition and early hydrologic evolution of Westwater Canyon wet alluvial-fan system, 7:102
**Galpin, J.V.,** Distributed systems in the heavy water plant environment, 7:244 (AECL—7056, pp 240-264)
**Gamble, R.L.,** *See* Lutes, I.G., 7:905
**Ganenko, V.B.,** Nucleon-nucleon potentials and quasi-free scattering of electrons by deuterons, 7:1559 (KFTI—79-48, pp 51-52)
**Ganguli, S.,** Dynamic theory of phase transition in hydrogen bonded ferroelectric crystals : Transverse susceptibility, 7:1650
**Ganguly, C.,** Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors, 7:419
**Gann, V.V.,** Foundations of the imitation theory of reactor damages of materials using heavy ion accelerators, 7:1641 (KFTI—79-65, pp 10-15)
Simulation of sub-threshold effects in nickel, 7:656 (KFTI—79-65, pp 16-20)
**Ganschow, O.,** *See* Tuempner, J., 7:950
**Gaonkar, S.G.,** Theoretical investigations of deviations from statistical equilibrium in planar channeling, 7:1639
**Garcia, J.I.,** *See* Martin, A., 7:328
**Garcia Guerra, P.A.,** *See* Da Vinha, C.A.G., 7:126
**Gardier, S.,** Image photon counting system for space astronomical observations, 7:949
**Gardiner, L.R.,** *See* Fallick, A.E., 7:764
**Gargouri, T.,** Oued Zeroud watershed management and Sidi Saad Dam protection, 7:1131 (IAEA-TECDOC—236, pp 52-65)
**Garkusha, V.I.,** Super high-energy intense neutrino beam shaping, 7:909 (INIS-mf—6295, pp 162-166)
**Garlick, A.,** Experience with a servo-hydraulic mechanical testing machine installed in a new shielded active facility at Windscale Nuclear Power Development Laboratories, 7:861
**Garner, B.E.,** *See* Clark, P.A., 7:878
**Garner, C.M.,** High efficiency silicon cells for luminescent solar concentrators, 7:250
**Gatzke, J.,** *See* Ross, W., 7:891
**Gauthier-Lafaye, F.,** Deposit of Oklo and its natural nuclear reactors, 7:91
**Gebicki, J.M.,** *See* Baumgartner, S., 7:1152
*See* Brown, M.A., 7:1144
**Gedrovits, Ya.Ya.,** Complex use of thermal analysis methods to study interaction of vanadium and titanium oxides with ammonium phosphates, 7:822
**Geffroy, J.,** Special spent fuel assemblies packaging method for the Creys-Malville power plant, 7:406 (INIS-mf—6447, pp vp)
**Gehr, H.L.,** Statistical methods for predicting failure probability of coated particles, 7:170
**Gehringer, C.,** *See* Beck, F., 7:1592
**Geisler, J.,** *See* Pensko, J., 7:1196
**Geithoff, D.,** Examination of heavily defected fuel-pin bundles, 7:516
**Geller, R.,** *See* Dousson, S., 7:1390
**Gellie, R.W.,** PROWAY - a standard for distributed control systems, 7:527 (AECL—7056, pp 65-100)
**Genesina, T.I.,** Radioactive sulphur metabolism in rat organism in the early stages of dental caries, 7:1232
**George, D.A.,** Engineer's view of science education, 7:1705 (NP—2900461)
**George, E.V.,** *See* Krupke, W.F., 7:1676
**Geranios, A.,** Variations of interplanetary parameters and cosmic-ray intensities, 7:1349
**Gerbst, A.V.,** *See* Kogan, I.A., 7:1217
**Gergely, T.E.,** Decameter radio and white light observations of the 21 August 1973 coronal transient, 7:1328
**Gerhold, H.R.,** *See* Buschbeck, B., 7:1512
**Gerinshtein, I.G.,** *See* Duma, V.A., 7:1235
*See* Pashenko, N.S., 7:1239
**Germain, M.,** *See* Cuillerdier, C., 7:702
**Gerrard, C.M.,** CSIRO coal research, with emphasis on mining, 7:7
**Gersberg, R.M.,** Isotope studies of nitrogen transformations in Castle Lake, California, 7:1010
**Gervers, J.H.,** High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state, 7:226 (NP—2900750)
**Geyh, M.A.,** Interpretation of environmental isotopic groundwater data. Arid and semi-arid zones, 7:1013
**Ghander, A.M.,** Optimum design of the electrostatic electron oscillator, 7:1440
Yield of negative ions from the duoplasmatron plasma, 7:1439
**Ghosh, A.,** Shortrange three-body interaction and the lattice statics and dynamics of CuI crystal, 7:734
**Ghosh, A.K.,** Analysis of colliding vibration of two cylinders, 7:460
**Ghosh, S.,** Quadrupolar deformation of the electronic charge cloud and the lattice mechanics of LiH-LiD crystals, 7:710
**Gibert, R.J.,** *See* Assedo, R., 7:321, 7:538
**Giblin, A.,** *See* Deutscher, R.L., 7:99
**Giblin, A.M.,** Role of clay adsorption in genesis of uranium ores, 7:83
**Gibson, A.,** *See* Watkins, M.L., 7:1677
**Gibson, B.F.,** Qualitative discussion of the A=4 hypernuclear isodoublet, 7:1626 (TRI—79-1, pp 121-123)
**Gibson, T.L.,** *See* Roberts, R.M., 7:827
**Gilchriese, M.,** *See* Stroynowski, R., 7:1488
**Gill, J.R.,** *See* Beaver, P.F., 7:630
**Gill, R.D.,** *See* Erents, S.K., 7:1678
**Gilles, J.P.,** Multiply charged ion beams of solids from sputter duoPIGatrons, 7:1389
*See* Lejeune, C., 7:1393
**Gillespie, G.H.,** Excitation and ionization of He by the impact of fast, complex ions. Asymptotic energy and charge state dependence, 7:1422
**Gilliam, D.M.,** *See* Eisenhauer, C.M., 7:295
**Gingrich, J.E.,** *See* Pedersen, C.P., 7:131
**Ginley, D.S.,** Optimization of solar conversion devices, 7:256
*See* Butler, M.A., 7:252
**Ginocchio, J.N.,** Intrinsic state for the interacting boson model and its relationship to the Bohr-Mottelson model, 7:1628
**Gitonga, J.,** Soil erosion, fertility and water conservation factors in agricultural activities in Kenya: A look at problems and efforts being made to solve them using radioisotope techniques, 7:1128 (IAEA-TECDOC—236, pp 140-146)
**Gittus, J.H.,** Theoretical free energies for superplasticity and dislocation creep. The origin of the high ductility in superplastic flow, 7:475 (IWGFPT—7, pp 103-108)
*See* Bowring, R.W., 7:552
**Gjovig, A.,** *See* Dawson, W.K., 7:1709
**Glaessel, P.,** *See* von Harrach, D., 7:1603
**Glaser, D.P.,** *See* Arbo, J.C., 7:638
**Glaum, F.,** *See* Kiefer, J., 7:1049
**Glavanakov, I.V.,** Pion photoproduction on bound nucleons, 7:1575 (KFTI—80-6, pp 14-15)
**Glawischnig, H.,** Advances and limitations of commercial ion-implantation equipment, 7:916
**Glenn, L.A.,** Dynamic loading of the structural wall in a lithium fall fusion reactor, 7:1704
**Glennie, K.W.,** Sole pit inversion tectonics, 7:21
**Gliddon, B.J.,** Methanation of carbon dioxide over a ruthenium catalyst for AGR gas circuit composition control, 7:248
**Gloeckner, H.J.,** Evaluation of seismic movements of a pebble bed reactor core as basis for shaking experiments, 7:593
**Glowinski, R.,** *See* Absi, E., 7:571
**Glumac, B.,** *See* Najzer, M., 7:435
**Gnedushkin, Yu.N.,** *See* Mikhajlov, P.A., 7:1223
**Go, V.L.W.,** *See* Weisner, R.H., 7:1073
**Godbout, P.,** Mechanistic assessment of structural failure for missile impacts on concrete structures, 7:393
**GodneVa, M.M.,** *See* Sedel'nikov, V.A., 7:701
**Goeller, B.,** Unconventional dynamic behaviour of thin spherical containment shells. A semi-analytical description, 7:600
**Goertz, C.K.,** *See* Stuedemann, W., 7:1380
**Gokhfeld, D.A.,** High-temperature design of elastic-plastic structures, 7:463
History dependence of stress-strain diagrams and creep curves under variable repeated loading, 7:692
**Gol'dberg, Yu.Sh.,** *See* Gedrovits, Ya.Ya., 7:822
**Gol'dshtein, V.A.,** Experimental study on the (e,e'p) reactions with helium isotopes, 7:1566 (KFTI—79-48, pp 84-86)

**Gol'tyapina, I.A.,** *See* Yasinova, A.A., 7:1220
**Golan, M.,** *See* Admon, U., 7:974
**Golchert, N.W.,** *See* Sedlet, J., 7:231
**Gold, R.,** Neutron emission observed from spent thermal reactor fuel assemblies, 7:293 (EUR—6813(Vol.2), pp 858-864)
**Goldanskii, V.I.,** *See* Keszthelyi, L., 7:844
**Goldman, C.R.,** *See* Gersberg, R.M., 7:1010
**Goldsmith, L.A.,** *See* Cross, M.T., 7:512
**Goleby, A.B.,** *See* Ferguson, J., 7:1254
**Goles, G.,** Geo- and cosmochemistry. Chapter 5. Section 2, 7:756
**Gomber, K.L.,** Etching behaviour of a soda glass detector, 7:965
*See* Singh, V.P., 7:964
*See* Yadav, J.S., 7:967
**Gomez Jaen, J.P.,** *See* Serrano, J.R., 7:152
**Gondol, J.,** *See* Koslik, S., 7:1111
**Gonen, T.,** Distribution-system planning using mixed-integer programming, 7:275
**Gonfiantini, R.,** *See* Salem, O., 7:1021
**Goodall, D.M.,** *See* Natzle, W.C., 7:830
**Goode, P.D.,** *See* Dearnaley, G., 7:676
**Goodman, A.M.,** Behaviour of plates subjected to steady mechanical load and rapid thermal transients on both surfaces, 7:467
**Gopal, E.S.R.,** *See* Bandyopadhyay, A.K., 7:1654
**Gorbenko, L.V.,** *See* Davydova, L.I., 7:1104
**Gorbenko, V.G.,** *See* Bochek, G.L., 7:1640
**Gordeev, Yu.S.,** *See* Watanabe, T., 7:1408
**Gorenko, A.F.,** Gamma activation analysis of organogenic elements in biologically active organometallic compounds, 7:743 (KFTI—79-40, pp 55-57)
*See* Antuf'ev, Yu.P., 7:742
**Gorman, J.G.,** *See* Emtage, P.R., 7:1453
**Goulevitch, J.,** Stratigraphy of the Kapalga Formation north of Pine Creek and its relationship to base metal mineralization, 7:72
**Gowda, K.A.,** *See* Cartz, L., 7:719
**Grachev, S.A.,** Effect of ionizing radiation sterilization dose on some polysaccharides, 7:836 (INIS-mf—5673, pp 68)
**Gracheva, T.V.,** *See* Bibikova, E.V., 7:1271
**Gradstein, F.M.,** *See* Berggren, W.A., 7:35
**Grande, L.,** *See* Serrano, J.R., 7:152
**Granger, H.C.,** *See* Ethridge, F.G., 7:105
*See* Finch, W.I., 7:130
**Granovskaya, N.N.,** Clinical and economic aspects of radiotherapy of nontumoral diseases, 7:1102
**Gravenor, J.G.,** *See* Garlick, A., 7:861
**Graves, J.M.,** *See* Kellow, G.N., 7:1146
**Gray, J.,** *See* Bainbridge, A., 7:426
**Gray, T.J.,** *See* Cocke, C.L., 7:1406
**Gray, W.D.T.,** Heather oil field, 7:40
**Grebennik, V.N.,** *See* Kharlamov, A.G., 7:338
**Green, A.A.,** *See* Simpson, C.J., 7:1256
**Green, I.S.,** *See* Curren, W.D., 7:846
**Green, L.O.,** *See* Smith, R., 7:367
**Green, M.W.,** Disconformities in Grants mineral belt and their relationship to uranium deposits, 7:139
**Greenstock, C.L.,** Bibliographies on radiation chemistry. 3. Formation and reactivity of the superoxide radical anion, 7:838
**Grey, A.J.,** Taking stock after INFCE, 7:619
**Griffin, J.A.,** *See* Bassett, R.L., 7:195
**Griffith, R.W.,** Introduction to basic aspects of plasma-deposited amorphous semiconductor alloys in photovoltaic conversion, 7:257
**Griffith, T.C.,** Positron interactions in gases, 7:1430
**Grillo, P.,** *See* Cardinale, A., 7:168
**Grimm, C.A.,** *See* Yule, H.P., 7:761
**Grimm, W.,** Real-time basic - principles and implementation for KRS 4200 minicomputers, 7:1706 (ZfK—410, pp 185-188)
**Grimont, B.,** *See* Coehinal, R., 7:951
**Grishaev, I.A.,** *See* Bochek, G.L., 7:1640
**Gritsenko, S.N.,** *See* Lutsenko, S.M., 7:1115
**Groos, E.,** Apparatus for fission gas release measurements from HTGR fuel elements at very high temperatures, 7:356
*See* Duwe, R., 7:355
**Grossiord, J.Y.,** *See* Bedjidian, M., 7:1581
**Grover, R.K.,** *See* Ghosh, A.K., 7:460
**Growcock, F.B.,** Graphite oxidation by moisture, 7:732
**Gruenhagen, A.,** *See* Erb, J., 7:1690
**Grundl, J.A.,** *See* Eisenhauer, C.M., 7:295
**Grunsven, Th.F.J. van,** *See* Hoyng, P., 7:1336
**Gruzdev, N.I.,** *See* Boguslyavskij, V.B., 7:470
**Guardini, S.,** Post irradiation analysis of high burn-up light water reactor fuel elements, 7:294 (EUR—6813(Vol.2), pp 865-872)
**Gubel, P.,** *See* van Asbroeck, P., 7:291
**Guelin, P.,** *See* Boisserie, J.M., 7:1663
**Guendel, H.,** Emission properties of nitrogen laser discharges, 7:898
*See* Bohmeyer, W., 7:1442
**Guesnier, G.,** Distributed architecture in the control of the PWR 1300 MW nuclear plants of electricite de France, 7:524 (AECL—7056, pp 20-31)
**Gulati, N.,** *See* Mangal, P.C., 7:778
**Gulitz, G.,** *See* Hirth, A., 7:889
**Gulson, B.L.,** Lead isotope studies at Jabiluka, 7:80
**Gupta, A.K.,** *See* Bhide, V.G., 7:1660
**Gupta, R.K.,** Multi-centre shell model, 7:1631
**Gur'ev, V.N.,** *See* Arkatov, Yu.M., 7:1564
**Gurkina, K.I.,** *See* Shul'ga, A.I., 7:1236
**Gusev, D.I.,** Radioactive contamination of the Soviet part of the mouth of the Danube and the adjacent area of the Black Sea in 1976-78, 7:1039 (IAEA-TECDOC—229, pp 153-157)
**Gustafson, G.T.,** *See* Lerner, U., 7:1075
**Gustafsson, I.,** *See* Bergenlid, U., 7:515
**Guthrie, G.L.,** Analysis and extension of the SAND-II code, 7:433 (EUR—6813(Vol.2), pp 700-707)
**Gutmann, G.,** *See* Baro, G., 7:307
**Guzzi, G.,** *See* Guardini, S., 7:294

## H

**Haas, D.,** Performance of mixed oxide fuel at high burnup and comparison with $UO_2$ fuel, 7:500 (IWGFPT—8, pp 92-103)
*See* Bairiot, H., 7:499
**Haas, J.L. Jr.,** *See* Clynne, M.A., 7:814
**Haas, R.A.,** *See* Krupke, W.F., 7:1676
**Haber, H.E.,** CPsup(N-1) model with unconstrained variables, 7:1533
**Haddrell, V.J.,** Optical devices for remote examination, 7:882
Refurbishing of a cave line at Berkeley Nuclear Laboratories, 7:865
Remotely operated scanning electron microscope for the examination of irradiated materials, 7:884
*See* Hines, G.F., 7:346
*See* Tozer, B.A., 7:345
**Haerendel, G.,** Auroral particle acceleration: an example of a universal plasma process, 7:1373 (ESA-SP—152, pp 21-29)
**Haeuser, J.,** Computer simulation of ion trajectories, 7:1473
**Hagenson, R.L.,** *See* Cort, C.E., 7:1702
**Haigh, C.P.,** *See* Gliddon, B.J., 7:248
**Haines, C.,** New thermal ionisation mass spectrometer, 7:788
**Hale, C.W.,** Advanced design concepts for post-irradiation examination facilities, 7:869
Method of study applied to safety of post-irradiation facilities, 7:879
**Hall, D.S.,** Influence of energy diffusion on auroral particle distributions, 7:1379 (ESA-SP—152, pp 285-288)
**Hall, M.C.G.,** Application of DUCKPOND to the OAK RIDGE PCA calculational blind test, 7:308
Preliminary version of the EURLIB variance-covariance matrices, 7:441
Simple comparison of adjusted data sets for iron based on measuremets in ASPIS and in the cores of fast reactor criticals, 7:415
**Hallett, D.,** Refinement of the geological model of the Thistle Field, 7:38
**Hammel, J.W.,** *See* Buck, K.E., 7:1693
**Hammeren, E.,** *See* Rekstad, J., 7:1588
**Hammerum, S.,** *See* Ingemann, S., 7:826
**Hampl, A.,** Nortestosterone RIA using dual antibody system, 7:1062 (INIS-mf—6419, pp vp)
**Hampl, R.,** *See* Dvorak, P., 7:1063, 7:1112
*See* Kozak, I., 7:1057
**Han, S.M.,** *See* Nakagawa, Y., 7:1361
**Hancock, N.J.,** Middle Jurassic North Sea Deltas with particular reference to Yorkshire, 7:27
**Handel, E.D.,** Positronium formation in aqueous micellar solutions. (I), 7:1385
**Hansen, M.V.,** International Uranium Geology Information System, 7:65
**Haque, A.K.M.M.,** 400 kV proton beam facility for the study of silicon semiconductor detector surfaces and of the stopping power of biological materials, 7:906
**Hara, S.,** *See* Sato, H., 7:1423
**Harayama, Y.,** Development of program FREC: theory and models, 7:480 (IWGFPT—7, pp 147-159)
**Harell, A.,** *See* Eilam, Y., 7:1074
**Hargitai, T.,** *See* Selivanov, V.M., 7:453
**Harker, A.B.,** Tailored ceramic nuclear waste forms: preparation and characterization, 7:204
**Harkness, S.D.,** *See* de Paz, J.F., 7:1687
**Harland, R.,** *See* Knox, R.W.O'B., 7:34
**Harley, J.H.,** Plutonium in the environment: a review, 7:996
**Harlow, F.H.,** *See* Daly, B.J., 7:557

**Harms, J.C.,** Brae oilfield area, 7:42
**Harriague, S.,** BACO fuel rod analysis computer program, 7:384
**Harries, D.R.,** *See* Bowkett, M.W., 7:645
**Harris, A.W.,** Of what practical value is knowledge of the cell biology and genetics of radiosensitivity, 7:1164 (INIS-mf—6531, pp vp)
*See* Lowenthal, J.W., 7:1145
**Harris, D.R.,** *See* Ryskamp, J.M., 7:407
**Harris, S.,** Uranium mining development in the Northern Territory: an overview of the issues, 7:229
**Harrison, F.L.,** *See* Knezovich, J.P., 7:1247
**Harrison, T.A.,** *See* Simpson, J.A., 7:351
**Harrop, L.P.,** Probabilistic modelling of in-service examination of PWR type reactor pressure vessels, 7:310
**Hart, D.M.,** *See* Lindsay, R., 7:1076
**Hart, H.R. Jr.,** *See* Fleischer, R.L., 7:150
**Hart, R.J.,** Distribution of U, Th and K through a section of the granitic crust of the Vredefort basement, 7:1274
**Hartley, P.E.,** *See* Airey, P.L., 7:1017
**Hartwig, S.,** Risk assessment for the transportation of $PuO_2$, $UF_6$ and spent fuel on roads in the Federal Republic of Germany, 7:176 (INIS-mf—6447, pp vp)
**Hasko, D.G.,** *See* Haque, A.K.M.M., 7:906
**Hassanein, A.M.,** *See* McCarville, T.J., 7:1703
**Hassib, G.M.,** *See* Massera, G.E., 7:957
**Hassmann, K.,** *See* Peehs, M., 7:562
**Haste, T.J.,** *See* Bowring, R.W., 7:552
**Hautojaervi, P.,** Positron-induced cluster and positronium bubble in low temperature helium, 7:1437
**Havard, D.J.,** *See* Colter, V.S., 7:53
**Havel, S.,** Aspects of design integrity for preparation of rules and standards for nuclear power plants in the Czechoslovak Socialist Republic, 7:312
**Hayakawa, S.,** Balloon observation of the galaxy australis in Australia, 7:1369
Observation of galactic super-soft x-ray using the satellite K-9M-60, 7:1366
**Hayashi, M.,** *See* Woodruff, W.L., 7:542
**Hayashi, S.,** Study of nuclear reactions in high energy using solid state track detectors, 7:913 (KURRI-TR—190, pp 10-13)
**Hayashi, T.,** *See* Doke, T., 7:936, 7:962
**Heberlein, J.V.R.,** *See* Emtage, P.R., 7:1453
**Hecker, R.,** *See* Stoever, D., 7:348
**Heersche, J.N.M.,** *See* Tam, C.S., 7:1077
**Heeschen, U.,** *See* Elfmann, W., 7:329
**Hegge, M.R.,** Geologic setting of the East Alligator uranium deposits and prospects, 7:69
**Hehn, G.,** Shielding data requirement for thermal power reactors of boiling water and gas cooled type, 7:286
**Heidebrecht, A.C.,** *See* Ishac, M.F., 7:595
**Heinemann, M.,** Mode-coupled MHD waves in the corona and solar wind, 7:1307
**Heinzelmann, M.F.M.,** Beta dosimetry with surface barrier detectors, 7:958
**Heiser, J.,** *See* Growcock, F.B., 7:732
**Heitz, Ch.,** *See* Collins, K.E., 7:652
**Helgason, T.,** Epidemiological follow-up research within a geographically stable population, 7:1119
**Heller, E.,** *See* Vowels, M.R., 7:1084
**Helman, W.P.,** *See* Greenstock, C.L., 7:838
**Hemment, P.L.F.,** Beam detection and dose measurement, 7:917
**Henkel, R.,** Astro 4 - a sounding rocket programme of the X-ray astronomy, 7:947
**Henley, J.W.,** *See* Holick, M.F., 7:1173
**Hennart, J.C.,** Study and measurement of impact damping in PWR reactor coolant system seismic and accident restraints, 7:325
**Henriquez, A.,** Negative parity states of $^{151}Sm$ in the particle-rotor model with exact treatment of the pairing and recoil term, 7:1593 (OUP—81-09, pp 49-51)
**Henry, D.,** *See* Pomathiod, L., 7:1391
**Henry, P.,** *See* Briot, F., 7:1186
**Hepburn, A.,** *See* McNeil, T., 7:532
**Hepburn, J.D.,** Spark-resistant design for high-voltage high-current accelerating columns, 7:918
**Herben, M.G.,** *See* van Voorthuisen, A.E., 7:1177
**Hering, W.,** *See* von Jan, R., 7:502
**Heritier, F.E.,** Frigg gas field, 7:55
**Hermoch, V.,** Particle flux emitted from a vacuum arc, 7:1455
**Hermsdorf, D.,** First results in evaluation of neutron nuclear data for Si, 7:1585 (ZfK—410, pp 147-156)
**Herren, M.,** Experimental verification of stress model calculations for HTR fuel particles, 7:169
**Herrmann, H.,** *See* Huebel, K., 7:1037
**Herrmann, K.H.,** Recombination in narrow-gapped semiconductors, 7:712 (INIS-mf—6449, pp vp)
**Herrmann, M.,** Principles of isotopic analysis by mass spectrometry, 7:744 (Zfl-Mitt—32, pp 32-41)
**Herrmann, U.,** *See* Kopp, E., 7:1374
**Hery, M.,** *See* Schneider, J.C., 7:425
**Hesslein, R.H.,** *See* Quay, P.D., 7:1028
**Heudorfer, W.,** *See* Hartwig, S., 7:176
**Heumann, K.G.,** Mass spectrometric isotope dilution analysis of trace amounts of halides, 7:765
**Heumos, K.,** Investigation of gas leakage from sealing constructions at containments for radioactive materials, 7:860 (INIS-mf—6447, pp vp)
**Heusser, G.,** *See* Wilhelm, R., 7:921
**Hewitt, R.G.,** *See* Melrose, D.B., 7:1673
**Hickey, J.W.N.,** United States programme for regulating radioactive airborne releases from licensed nuclear facilities, 7:564
**Hicks, R.T.,** Petrology of Westwater Canyon member, Morrison Formation, East Chaco Canyon drilling project, New Mexico-comparison with Grants mineral belt, 7:115
**Higginson, P.R.,** Laser cutting equipment for dismantling irradiated PFR fuel sub-assemblies, 7:886
*See* Edmonds, E., 7:408
**Highfill, R.,** *See* Hoffman, E.J., 7:1118
**Higley, B.A.,** *See* Schulz, W.W., 7:199
**Hildenbrand, K.D.,** *See* von Harrach, D., 7:1603
**Hill, M.P.,** *See* Brown, A.B., 7:659
**Hilliker, A.J.,** Nature of radiation-induced chromosomal interchanges in Drosophila oocytes, 7:1163 (INIS-mf—6531, pp vp)
**Hilpert, K.,** *See* Schladot, J.D., 7:1
**Hinchliffe, I.,** *See* Haber, H.E., 7:1533
**Hindmarch, P.,** *See* Garlick, A., 7:861
**Hinds, H.W.,** Intelligent safety system concept for future CANDU reactors, 7:546 (AECL—7056, pp 318-323)
**Hines, G.F.,** Objectives and organisation of a national post-irradiation examination programme for commercial advanced gas-cooled reactor fuel, 7:344
Review of non-destructive testing techniques employed by the CEGB for the post-irradiation examination of Magnox and CAGR fuel, 7:346
*See* Cribb, R.J.P., 7:342
**Hinterleitner, H.,** Experimental verification of a PCPV concept with elastic hot liner and regulated wall temperature, 7:446 (IWGHTR—2, pp 106-114)
*See* Schwiers, H.G., 7:373
**Hirano, H.,** *See* Noda, T., 7:820
**Hirano, T.,** Corrosion of inconel 617 in simulated HTGR helium environment, 7:684
**Hirashima, Y.,** *See* Watanabe, H., 7:1368
**Hirth, A.,** Investigation of a high power tunable dye laser, 7:889
**Hitchcock, P.A.,** Instrument to measure the wear scars formed on the tie bar of the CAGR fuel assembly, 7:354
**Hizo, J.,** *See* Duftschmid, K.E., 7:952
**Hlavaty, L.,** Computer code for nuclear decay scheme construction, 7:1555 (INIS-mf—6479, pp vp)
**Hlavkova, J.,** *See* Svobodova, M., 7:1113
**Hoare, D.E.,** *See* Falconer, J.W., 7:832
**Hobbs, J.E.,** *See* Marwick, A.D., 7:920
**Hobson, G.D.,** *See* Illing, L.V., 7:13
**Hoch, M.,** Precipitation reactions in austenitic stainless steels, 7:166
**Hochman, M.B.,** Geochemical investigations in the Mt. Bundey area, Northern Territory, 7:1272
**Hoclet, O.,** *See* Alberman, A., 7:289
**Hoegaasen, H.,** Colour isomers in multiquark systems, 7:1517
**Hoerber, E.,** *See* Bienlein, J.K., 7:1496
**Hoetzl, H.,** Isotope methods as a tool for Quaternary studies in Saudi Arabia, 7:1025
**Hoeve, J.,** Athabasca basin unconformity-type uranium deposits. A special class of sandstone-type deposits, 7:87
**Hoffman, E.J.,** New tomograph for quantitative positron emission computed tomography of the brain, 7:1118
**Hoffmann, P.,** *See* Grimm, W., 7:1706
**Hohmuth, K.,** *See* Ross, R., 7:713
**Hol, A.C.P.J.,** *See* Oele, J.A., 7:54
**Holder, M.,** QCD-tests in lepton nucleon scattering experiments, 7:1535
**Holen, H.K.,** *See* Chenoweth, W.L., 7:136
**Holick, M.F.,** Photoproduction in skin of 1α,25-dihydroxyvitamin $D_3$: a novel approach to therapy of vitamin-D-resistant syndromes, 7:1173
**Holick, S.A.,** *See* Holick, M.F., 7:1173
**Holik, J.,** *See* Veres, K., 7:1056
**Holladay, G.,** *See* Clegg, B., 7:1007
**Holland, J.A.,** *See* Aird, H.M., 7:370
**Hollowell, T.E.,** Failure boundary for stress corrosion cracking based on fuel temperature and cladding load. A

new approach to improving fuel reliability, 7:493 (IWGFPT—8, pp 200-203)
**Holm, E.,** Studies of concentration and transfer factors of natural and artificial actinide elements in a marine environment, 7:1048
**Holmes, F.A.,** *See* Emtage, P.R., 7:1453
**Holmes, R.S.,** Research activities of the Medical Research Council's Radiobiology Unit at Harwell, Great Britain, 7:1143 (INIS-mf—6531, pp vp)
**Holt, R.A.,** Model for the kinetics of the α diversable β phase transformation in Zircaloy-4, 7:654 (IWGFPT—7, pp 17-20)
**Holzwarth, J.F.,** *See* Natzle, W.C., 7:830
**Honda, Y.,** *See* Kaneko, H., 7:505
**Hone, I.G.,** *See* Tucker, D.H., 7:1264
**Hooper, E.B.,** *See* Leung, K.N., 7:911
**Hoppe, N.,** PCMI modelling in COMETHE, 7:496 (IWGFPT—8, pp 287-294)
**Horacek, P.,** Mission of the central commission of the Czechoslovak Academy of Agriculture for use of energy resources and nuclear methods in agriculture, 7:1133 (INIS-mf—6420, pp vp)
**Horanyi, S.,** *See* Selivanov, V.M., 7:453
**Horie, T.,** *See* Masuda, M., 7:1698
**Horsky, J.,** Non-statical sources of the Taub and Kasner solutions of Einstein equations, 7:1661 (INIS-mf—6479, pp vp)
**Horvatincic, N.,** *See* Srdoc, D., 7:1020
**Horvay, G.,** Dynamic plastic buckling of shells. A reconsideration of the Vaughan-Florence analysis, 7:598
**Horwitz, E.P.,** Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
Extraction of Th(IV) and U(VI) by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:745
**Hoshino, T.,** *See* Kaneko, H., 7:220
**Hossain, D.,** *See* Haque, A.K.M.M., 7:906
**Hotchkiss, R.C.,** *See* Gliddon, B.J., 7:248
**Houldsworth, J.,** *See* Ford, M., 7:1245
**Houlton, M.R.,** *See* Bennett, M.J., 7:358
**Hoursiangou, D.,** *See* Bonotto, S., 7:1192
**Houze, R.N.,** *See* Sullivan, J.P., 7:904
**Howard, R.,** *See* LaBonte, B.J., 7:1290
**Howard, R.A.,** *See* Michels, D.J., 7:1348
*See* Sheeley, N.R. Jr., 7:1297
**Howl, D.A.,** Review of the fuel failures in batch 8 fuel from the Haddam Neck Reactor, 7:303 (IWGFPT—8, pp 13-18)
*See* Baylis, C.C., 7:300
**Hoyng, P.,** Model for impulsive electron acceleration to energies of tens of kTsub(e), 7:1336
**Hsieh, H.J.,** *See* Wilson, H.W., 7:476
**Hua, L.C.,** Super element model development and analysis on the Mark I torus structure, 7:577
**Huang, S.C.,** *See* Hoffman, E.J., 7:1118
**Huddleston, A.L.,** Clinical determination of absolute density in bone utilizing single and dual energy compton scattering, 7:1098
**Hudson, B.J.,** *See* Seagren, R.D., 7:172
**Huebel, K.,** Radiological analysis of the river system of the upper Danube, 7:1037 (IAEA-TECDOC—229, pp 55-93)
**Huebschmann, W.G.,** Extent of emergency actions for the protection of the public after accidental activity releases from nuclear power plants, 7:567
**Hueckel, T.,** Hysteresis behaviour of soils and rocks, 7:1269
**Huesman, R.H.,** *See* Derenzo, S.E., 7:1086
**Huffman, A.C. Jr.,** Depositional environments as ore controls in salt wash member, Morrison Formation (Upper Jurassic), Carrizo Mountains area, Arizona and New Mexico, 7:107
**Huggins, R.A.,** *See* Boukamp, B.A., 7:607
**Hughes, R.J.,** *See* Lawrence, C.R., 7:232
**Hugot, G.,** *See* Assedo, R., 7:538
**Hult, J.,** Material damage in structural analysis, 7:466
**Humphrey, J.,** *See* Wise, J., 7:1487
**Hunt, D.N.,** *See* O'Brien, D.W., 7:1708
**Huntington, J.F.,** *See* Simpson, C.J., 7:1256
**Hunton, A.E.,** *See* Mizzan, E., 7:863
**Husak, V.,** Radiation risks from $^{125}I$ in RIA laboratories - internal contamination and burden to hands, 7:1243 (INIS-mf—6419, pp vp)
**Husband, J.E.,** CT guided percutaneous fine needle aspiration of intra-abdominal and pelvic masses, 7:1095
**Huskova, M.,** Determining normal values of plasma renin activity in children, 7:1055 (INIS-mf—6419, pp vp)
*See* Topolcan, O., 7:1054
**Husslage, W.,** *See* Konter, A.W.A., 7:698
**Hutchinson, J.J.,** *See* Corsetti, L.V., 7:876

## I

**Ichikawa, M.,** Analysis of PCI by FEMAXI-III, 7:501 (IWGFPT—8, pp 149-159)
FEMAXI-III: an axisymmetric finite element computer code for the analysis of fuel rod performance, 7:483 (IWGFPT—7, pp 216-227)
*See* Ito, K., 7:479
**Ichikawa, Y.,** *See* Nagakura, T., 7:174
**Ichinokawa, T.,** Temperature dependence of sputtering rate of alkali halides by $Ar^+$ bombardment, 7:1427
**Igarashi, T.,** Field vibration test results and design for reactor coolant piping systems of ATR 'Fugen', 7:597
**Ignatiev, A.,** Optical properties-microstructure relationship in particulate media: optical tailoring of solar absorbers, 7:262
**Ihle, H.R.,** Experimental study of gaseous lithium deuterides and lithium oxides. Implications for the use of lithium and $Li_2O$ as breeding materials in fusion reactor blankets, 7:1680
**Ihle, U.W.,** *See* Nguyen, V.U., 7:10
**Iida, K.,** Applicability of JIS SPV 50 steel to primary containment vessels of nuclear power stations, 7:670
**Ilberg, D.,** Some radiation protection implications of the Three Mile Island incident, 7:563
**Ilievova, M.,** *See* Svobodova, M., 7:1113
**Illi, H.,** *See* Warnecke, E., 7:194
**Illing, L.V.,** Petroleum geology of the continental shelf of northwest Europe, 7:13
**Imai, H.,** *See* Sasaki, Y., 7:731
**Imai, Y.,** Postoperative hypoparathyroidism followed by Parkinsonium, 7:1174
**Imboden, D.M.,** Natural radon as a limnological tracer for the study of vertical and horizontal eddy diffusion, 7:1029
**Imray, P.,** Human genetic disorders showing sensitivity to DNA-damaging agents. Strategies for future studies, 7:1166 (INIS-mf—6531, pp vp)
*See* Chen, P., 7:1149
*See* Leyden, M., 7:1159
**Imrie, D.C.,** Multiwire proportional and drift chambers: from first principles to future prospects, 7:941 (RL—80-043, pp 279-290)
**Inahara, K.,** Leak detection system with distributed microprocessor in the primary containment vessel, 7:535 (AECL—7056, pp 214-225)
**Inal, O.T.,** *See* Murr, L.E., 7:641
**Ingebretsen, F.,** *See* Rekstad, J., 7:1588, 7:1595
**Ingemann, S.,** Secondary isotope effects on alpha-cleavage reactions, 7:826
**Inglebert, G.,** *See* Zarka, J., 7:464
**Inglin, H.F.,** *See* Budding, M.C., 7:39
**Inhaber, H.,** *See* Parzyck, D.C., 7:1052
**Inopin, E.V.,** *See* Nagornyi, S.I., 7:1561, 7:1621
**Inoue, T.,** *See* Isoya, A., 7:1394
**Intriligator, D.S.,** Transient phenomena originating at the Sun - an interplanetary view, 7:1344
**Ireland, D.R.,** Evidence for the relative importance of dynamic fracture toughness, 7:690
**Irleweck, K.,** Comparison of mass-spectrometry and α-counting in analysis of uranium and plutonium isotopes in environmental samples, 7:767
**Irmer, J.,** *See* Guendel, H., 7:898
**Isgur, N.,** Hyperon physics and chromodynamics, 7:1531 (TRI—79-1, pp 33-42)
**Ishac, M.F.,** Coupled lateral-torsional response of equipment mounted in CANDU nuclear power plants, 7:595
**Ishii, K.,** Inner shell ionization accompanied by electron bremsstrahlung, 7:1412
*See* Kamiya, M., 7:1415
*See* Sera, K., 7:1400
**Ishikawa, K.,** *See* Iida, K., 7:670
**Isoya, A.,** Proton source for the high-intensity Lamb-shift-type polarised ion source, 7:1394
**Issar, A.,** *See* Levin, M., 7:1011
**Ito, K.,** Comparison of FEMAXI-III code calculations with irradiation experiments, 7:479 (IWGFPT—7, pp 138-146)
*See* Ichikawa, M., 7:483, 7:501
**Ito, S.,** K-shell ionization of gold by electron and positron impact near the threshold energy, 7:1402
**Ito, Y.,** *See* Okada, S., 7:1436
**Itoh, J.,** *See* Ohtani, N., 7:416
**Iucci, N.,** Two classes of fast solar wind streams: their origin and influence on the galactic cosmic ray intensity, 7:1350

**Ivanchenko, A.I.,** *See* Vorontsov, S.S., 7:1443
**Ivanitskaya, V.I.,** Dynamics of radiocardiographic indices in radiation treatment of patients with mammary gland cancer, 7:1214
*See* Duma, V.A., 7:1235
*See* Pashenko, N.S., 7:1239
**Ivanov, O.S.,** *See* Alekseeva, Z.M., 7:671
**Ivanova, L.N.,** *See* Belyaev, V.A., 7:1279
**Iwadate, T.,** *See* Tsukada, H., 7:666
**Iwai, T.,** *See* Kaneko, Y., 7:1414
**Iwamoto, N.,** Self-diffusion study of lithium in molten salt related to molten breeder reactor, 7:428
**Iwanami, H.,** *See* Hayakawa, S., 7:1366
**Iwano, Y.,** *See* Ichikawa, M., 7:483
**Iwashita, T.,** *See* Kubota, J., 7:420
**Iwata, S.,** *See* Hayashi, S., 7:913
**Iyer, R.S.,** *See* Bhat, I.S., 7:1047
**Izard, M.E.,** Radiation effects on electrophoretic properties of bacterial spores, 7:1153 (INIS-mf—6531, pp vp)
**Izumi, F.,** *See* Harayama, Y., 7:480

## J

**Jackson, B.V.,** Association of type III bursts and coronal transient activity, 7:1346
**Jackson, N.,** *See* Brown, P.E., 7:868
**Jacobs, G.P.,** *See* Sade, N., 7:1191
**Jacobsen, L.C.,** Sedimentary controls on uranium ore at L-Bar deposits, Laguna District, New Mexico, 7:146
**Jacquet-Francillon, N.,** *See* Bonniaud, R., 7:211
**Jacquot, B.,** *See* Dousson, S., 7:1390
**Jadhav, D.B.,** *See* Bhatnagar, A., 7:1326
**Jaeskaelainen, M.,** *See* Rekstad, J., 7:1588
**Jaffe, L.D.,** Heat engine requirements for advanced solar thermal power systems, 7:258
**Jahn, H.,** Absolute values of inelastic neutron scattering cross-sections calculated with account taken of the pre-equilibrium mechanism, 7:1612 (IAEA-SMR—43, pp 293-304)
**Jain, R.M.,** *See* Bhatnagar, A., 7:1326
**Jakes, D.,** Instrument for monitoring activity in liquid sodium, 7:404 (INIS-mf—6423, pp vp)
*See* Westrum, E.F. Jr., 7:849
**Jakubowicz, H.,** *See* Prost, J.P., 7:322
**Jamar, C.,** *See* Gardier, S., 7:949
**James, H.E.,** *See* Simonsen, H.A., 7:156
**Jamieson, H.C.,** *See* Causey, A.R., 7:389
**Janouskova, M.,** *See* Fingerova, H., 7:1066
**Janson, J.,** *See* Hult, J., 7:466
**Janssen, G.T.M.,** *See* Konter, A.W.A., 7:698
**Janssens, A.,** *See* Eggermont, G., 7:992
**Jantzen, C.M.,** *See* Harker, A.B., 7:204
**Janvier, J.C.,** *See* Kauffmann, Y., 7:703
**Jareno, A.,** *See* Santos, J.M., 7:1093
**Jaroszewicz, T.,** Drell-Yan process as a test of models for particle production on nuclei, 7:1514
**Jarsky, I.,** *See* Fresl, M., 7:648
**Jaske, C.E.,** High cycle fatigue of 2.25Cr-1Mo steel at elevated temperatures, 7:662
**Jayaprakash, T.,** Study of the instrumental and other aspects in the mass spectrometric analysis of deuterium content, 7:781
**Jefferies, D.K.,** *See* Prewett, P.D., 7:1392
**Jenkins, J.T. Jr.,** Depositional environment of Brushy Basin Member, Morrison Formation, in Gulf Mariano Lake mine, McKinley County, 7:111
**Jenkinson, I.S.,** Cell production and loss rates in basal and squamous cell carcinomata, before and after irradiation, 7:1147 (INIS-mf—6531, pp vp)
**Jenner, J.K.,** Structure and stratigraphy of the Kish Bank Basin, 7:48
**Jennings, P.,** *See* Lavin, M., 7:1148
**Jensen, D.A.,** *See* Wise, J., 7:1487
**Jensen, H.N.,** *See* Wentworth, D.W., 7:109
**Jeppesen, R.,** Safety design, 7:603
**Jepson, M.D.,** *See* Bowen, J., 7:885
*See* Hale, C.W., 7:879
**Jeste, G.,** *See* Pineira, T., 7:511
**Jezabek, M.,** *See* Jaroszewicz, T., 7:1514
**Jiri, M.,** *See* Zdenek, K., 7:454
**Jirkovsky, R.,** First radiometric logging studies in Czechoslovakia in surveying geological dislocations, 7:1265 (INIS-mf—6422, pp vp)
Radiometric survey of water dam areas in the Beskydy Mountains, 7:249 (INIS-mf—6422, pp vp)
**Job, C.,** *See* Hoetzl, H., 7:1025
**Jockwer, N.,** Laboratory investigation of water content within rock salt and its behavior in a temperature field of disposed high-level waste, 7:196
**Johnson, C.J.,** Evaluation of cancer incidence for Anglos in the period 1969-1971 in areas of census tracts with measured concentrations of plutonium soil contamination downwind from the Rocky Flats Plant in the Denver standard metropolitan statistical area, 7:1195
**Johnson, J.J.,** *See* Schlafer, W. III, 7:592
**Johnson, P.A.V.,** *See* Smith, R., 7:367
**Johnson, R.,** Towards the development of mechanistically-based design rules for corrosion fatigue in ductile steels, 7:660
**Johnson, R.J.,** Caledonides: their influence on the stratigraphy of the Northwest European continental shelf, 7:18
**Johnson, W.C.,** *See* Phillips, B.F., 7:1428
**Johnsson, B.,** *See* Menon, S., 7:555
**Johnston, R.G.,** *See* Schulz, W.W., 7:199
**Johnstone, A.D.,** Wave-particle interactions in the high altitude auroral ionosphere, 7:1375 (ESA-SP—152, pp 243-255)
**Johnstone, I.R.,** *See* Collier, D., 7:533
**Joly, J.J.,** *See* Geffroy, J., 7:406
**Jones, M.J.,** Complex metallurgy '78, 7:160
**Jones, R.T.,** *See* Otter, N.R., 7:379
**Jorgensen, F.,** Geology of the Norwegian Shelf between 62°N and the Lofoten Islands, 7:46
**Joseph, J.,** *See* Atabek, R., 7:305
*See* Dehon, C., 7:306
**Joshi, G.C.,** *See* Ellis, R.G., 7:1508
**Joshi, K.P.,** Effective interactions for nuclear structure, 7:1633
**Jouan, A.,** *See* Bonniaud, R., 7:211
**Jover, P.,** Distributed systems for the protection of nuclear stations, 7:443 (AECL—7056, pp 282-289)
**Joy, D.S.,** *See* Seagren, R.D., 7:172
**Juettner, B.,** Minimum conditions for cathode erosion by electrical discharges in UHV, 7:1446
*See* Rohrbeck, W., 7:1447
*See* Siemroth, P., 7:1448
**Juhn, P.E.,** Study on the future nuclear power development strategy in Korea, 7:622
**Jull, A.J.T.,** *See* Fallick, A.E., 7:764
**Jung, W.,** *See* Peehs, M., 7:503
**Jungklaus, D.,** *See* Alter, U., 7:180
**Justiniano, E.,** *See* Cocke, C.L., 7:1406

## K

**Kabakchi, S.A.,** *See* Spitsyn, V.I., 7:215
**Kachan, A.S.,** Combined analysis of the angular correlations in the (p,γ) and (p,p'γ) reactions, 7:1584 (KFTI—79-40, pp 5-6)
**Kadysh, I.J.,** *See* Demirkhanov, R.A., 7:1461
**Kaempf, F.,** Application of the VAW tube digester for metallurgical pressure-leaching processes, 7:159
**Kaesler, R.L.,** *See* Cairns, J. Jr., 7:1114
**Kafka, P.,** *See* Schueller, G.K., 7:578
**Kagawa, T.,** *See* Tokubuchi, T., 7:208
**Kahler, S.W.,** X-ray structures associated with disappearing Hα filaments in active regions, 7:1298
**Kaiser, E.J.,** Adoption of energy conservation features in new homes: current practices and proposed policies, 7:637 (PAS—349, pp 23-30)
**Kaiser, R.S.,** *See* Fici, J.A., 7:304
*See* Leech, W.J., 7:299
**Kakinuma, T.,** *See* Washimi, H., 7:1362
**Kakodkar, A.,** *See* Ghosh, A.K., 7:460
**Kalbfleisch, G.,** *See* McCal, D., 7:1499
**Kalina, D.G.,** *See* Horwitz, E.P., 7:745, 7:746
**Kamiya, M.,** Contribution of electron transfer to K-shell ionizations by $N^{7+}$-ion bombardment, 7:1415
*See* Sera, K., 7:1400
**Kanda, K.,** Technical problems in case of utilizing uranium of medium enrichment for a research reactor, 7:543 (KURRI-TR—192, pp 6-11)
*See* Woodruff, W.L., 7:542
**Kane, S.R.,** Recent observations of energetic electrons in solar flares, 7:1324
**Kaneko, H.,** Iodine removal in the Purex reprocessing process, 7:220
PCI performance of $PuO_2$-$UO_2$ fuels irradiated in water reactors, 7:505 (IWGFPT—8, pp 103-111)
**Kaneko, M.,** *See* Domoto, K., 7:551
**Kaneko, Y.,** Symmetric resonance electron transfer of multiply charged ions at low energies: A sup(+) + A - A + A sup(q+) (q <= 7), 7:1414
**Kang, K.,** Unified gauge theories and the problem of mass, 7:1550 (IPNO-TH—80-49, pp Pt.1 p.1)
**Kang, Y.H.,** Fluorescent X-ray spectroscopic analysis using radioisotopes, 7:762
**Kania, M.J.,** Irradiation performance assessment of coated particle fuels using the IMGA system, 7:349
**Kaniah, M.J.,** *See* Robbins, J.M., 7:747

**Kankeleit, E.,** *See* Backe, H., 7:1411
**Kanomata, I.,** *See* Sakudo, N., 7:1387
**Kanter, M.,** *See* Chavet, I., 7:908
**Kaplan, L.,** *See* Horwitz, E.P., 7:746
**Kapoor, S.,** Mass spectrometers as an analytical tool in heavy water production, 7:246
Mass spectrometric analysis of deuterium in water, 7:783
**Karel, M.,** *See* Zdenek, K., 7:454
**Karino, M.,** *See* Ogata, Y., 7:412
**Karioris, F.G.,** *See* Cartz, L., 7:719
**Karkhanis, S.N.,** Stable product low leach glasses, 7:202
*See* Nesbitt, H.W., 7:203
**Karlov, N.P.,** *See* Selivanov, V.M., 7:453
**Karnaukhov, I.M.,** *See* Petrusenko, Yu.T., 7:247
**Karpovich, I.P.,** *See* Davydova, L.I., 7:1104
**Kartashev, V.P.,** *See* Garkusha, V.I., 7:909
**Kartvelishvili, V.G.,** D-meson inclusive production in $e^+e^-$ annihilation, 7:1519
Production of D- and PSI-mesons in hadron interactions, 7:1520
**Kasai, Y.,** *See* Muto, K., 7:596
**Kase, M.,** *See* Nakai, Y., 7:1398
**Kashihara, H.,** *See* Matsushima, H., 7:514
**Kashima, K.,** *See* Ichikawa, M., 7:483
**Kastenberg, W.E.,** *See* Okrent, D., 7:1686
**Kathren, R.L.,** $^{230}$Th assay by epithermal neutron activation analysis, 7:776
**Kats, M.E.,** *See* Dorman, L.I., 7:1281
**Katz, F.,** Coupled fluid-structure analysis of the core barrel behaviour during blowdown, 7:583
*See* Schumann, U., 7:579
**Kauffmann, Y.,** Unconstrained swelling of $UO_2$, 7:703 (IWGFPT—7, pp 67-76)
**Kaufman, D.,** *See* Correia, J.A., 7:1087
**Kaufman, W.B.,** Atomic bound states of the proton anti proton system, 7:1505 (TRI—79-1, pp 160-163)
**Kauranne, L.K.,** Estimation of the uranium potential of Finnish bedrock, 7:128
**Kavkalo, N.N.,** *See* Marega, I.N., 7:1100
**Kawai, M.,** *See* Ohtani, N., 7:416
**Kawakatsu, T.,** *See* Shiraki, K., 7:591
**Kawamura, A.,** *See* Fujii, K., 7:526
**Kawamura, K.,** *See* Shui, V.H., 7:984
**Kawanishi, K.,** *See* Kitade, K., 7:288
**Kawaratani, T.,** *See* Ito, S., 7:1402
**Kawatsura, K.,** Multiple k-shell ionization of fluorine by hydrogen and helium ion impacts, 7:1403
**Kazachek, T.N.,** *See* Mil'ko, V.I., 7:1105
**Kazmerski, L.,** Introduction to photovoltaics: physics, materials and technology, 7:253
Research and device problems in photovoltaics, 7:254
**Kean, G.E.,** *See* Galpin, J.V., 7:244
**Keating, R.,** *See* Annen, K.D., 7:634
**Keats, A.B.,** Fail-safe design criteria for computer-based reactor protection systems, 7:545 (AECI—7056, pp 306-317)
**Keclik, I.,** Results of a study in stress manifestations in OKR mines by the gamma-gammametric method, 7:12 (INIS-mf—6422, pp vp)
Study of some characteristics of a rock massif by radioisotope methods, 7:1267 (INIS-mf—6422, pp vp)
*See* Blaha, F., 7:11
*See* Dvorak, D., 7:1266
**Keep, C.W.,** Effect of surface pretreatment on the growth of carbon onto stainless steel from the decomposition of propane, 7:825
Nickel-catalysed gasification of graphite by carbon dioxide, 7:725
**Keep, R.H.,** *See* Clark, P.A., 7:878
**Keiser, J.R.,** Compatibility of molten salts with type 316 stainless steel and lithium, 7:678
**Kellow, G.N.,** Evidence for an indirect effect of radiation on mammalian chromosomes, 7:1146 (INIS-mf—6531, pp vp)
**Kelly, P.J.,** *See* Lemon, G.J., 7:1078
**Kelly, T.E.,** Effects of uranium mining of ground water in Ambrosia Lake area, New Mexico, 7:233
**Kelm, J.R.,** *See* Mizzan, E., 7:863
**Kemter, F.,** *See* Gloeckner, H.J., 7:593
**Kennedy, N.A.,** *See* Krishnasamy, S.G., 7:469
**Kennedy, R.C.,** *See* McDowell, R.S., 7:829
**Keren, M.,** Continuous level gauge for horizontal cylindrical vessels, 7:932 (IA—1356, pp 299-301)
**Kerr, C.,** Hazards to the health of uranium workers and the regional population, 7:239
**Kervalishvili, N.A.,** Electron density distribution in anode sheath of low pressure discharge in cross Esub(perpendicular)H fields, 7:1457
**Keskinen, R.,** Vibration of three-dimensional piping subject to pump pulsation, 7:324
**Keszthelyi, L.,** Racemization and the origin of asymmetry of biomolecules. Chapter 17, 7:844
**Ketchen, J.,** *See* Blanchard, A., 7:362
**Ketel, T.J.,** *See* Bruckner, W., 7:1579, 7:1582
**Keyser, R.,** *See* Hoffman, E.J., 7:1118
**Kezerashvili, R.Ya.,** *See* Dzhibuti, R.I., 7:1562, 7:1563
**Khan, A.,** Etching and annealing behaviour of glass nuclear track detector, 7:963
**Kharlamov, A.G.,** Thermal insulation of the high-temperature helium-cooled reactors, 7:338 (IWGHTR—2, pp 84-94)
**Khatun, S.,** *See* Sarkar, S., 7:1630
**Khodachenko, G.V.,** *See* Tyuryukanov, P.M., 7:1459, 7:1460
**Khodakovskij, I.I.,** *See* Fuger, J., 7:847
**Khorenko, V.K.,** Target heater for the experiments on the reactor damage simulation in accelerators, 7:450 (KFTI—79-65, pp 86-87)
**Kicherer, G.,** *See* Hehn, G., 7:286
**Kidson, C.,** *See* Chen, P., 7:1149
*See* Imray, P., 7:1166
**Kiefer, J.,** $^{226}$Ra- and $^{222}$Rn-content of drinking water, 7:1049
**Kifmann, R.,** *See* Heumann, K.G., 7:765
**Kikuchi, A.,** *See* Nakai, Y., 7:1398
**Kikutake, T.,** Improvement of properties in heavy section nuclear reactor steel plates, 7:669
**Kimblin, C.W.,** Anode spot ion currents and the interaction with axial magnetic fields, 7:1454
*See* Emtage, P.R., 7:1453
**Kimlova, I.,** Problems of tumour antigen determination, 7:1061 (INIS-mf—6419, pp vp)
**Kinoshita, M.,** *See* Ichikawa, M., 7:501
**Kirchmann, R.,** *See* Bonotto, S., 7:1192
**Kirchner, B.,** Importance of leak flow mode assumptions for interpretation of package leaktightness tests and influence of test conditions on conclusions, 7:853 (INIS-mf—6447, pp vp)
**Kirchner, G.,** Key Lake U-Ni deposits. A model for Lower Proterozoic uranium deposition, 7:89
**Kirilov, A.E.,** *See* Elaev, V.F., 7:894
**Kirk, A.R.,** *See* Huffman, A.C. Jr., 7:107
**Kirov, A.G.,** *See* Demirkhanov, R.A., 7:1461
**Kirsch, J.,** K-Mo-radiation in heavy ion collisions, 7:1410
*See* Soff, G., 7:1409
**Kirschner, R.,** Jet properties and the parton interpretation of the leading log scheme, 7:1554
**Kirson, M.W.,** *See* Ginocchio, J.N., 7:1628
**Kiselevskii, L.I.,** Wave structure of an electric discharge cathode zone in the helium flow, 7:1464
**Kishimoto, Y.,** *See* Narita, O., 7:993
*See* Shinohara, K., 7:953
**Kislichenko, V.A.,** *See* Kogan, I.A., 7:1217
*See* Pashenko, N.S., 7:1239
**Kita, K.,** *See* Murase, H., 7:682
**Kitade, K.,** Experimental study of pipe reaction force and jet impingement load at the pipe break, 7:288
*See* Shiraki, K., 7:591
**Kitagawa, M.,** Electron capture and loss to, or from wake-riding states by fast ions in metals, 7:1418
*See* Asada, Y., 7:664
**Kitahara, Y.,** *See* Narita, O., 7:993
*See* Shinohara, K., 7:953
**Kitajima, S.,** *See* Tokubuchi, T., 7:208
**Kitt, G.P.,** *See* Brown, P.E., 7:868
**Kittel, W.,** *See* Buschbeck, B., 7:1512
**Kleiber, M.,** *See* Borkowski, A., 7:1668
**Klein, I.,** Comparison of bone resorption and bone-blood calcium equilibrium in vertebrates, 7:1081
*See* Wong, K.M., 7:1080
**Kleinbauer, K.,** *See* Husak, V., 7:1243
**Kleist, G.,** *See* Cords, H., 7:737
**Klemensevic, J.,** Problems of building sodium test circuit at VUZES, 7:397 (INIS-mf—6423, pp vp)
**Klepatskii, A.B.,** *See* Zenevich, V.A., 7:1602
**Kliesch, G.,** Standardization and workers' protection legislation, 7:1050
**Klimkin, V.M.,** *See* Bokhan, P.A., 7:895
**Klimov, A.N.,** Simplification of calculation algorithm for $\gamma$-spectra processing, 7:1645
**Klimovski, I.I.,** Connection of the copper vapour laser emission pulse characteristics with plasma parameters, 7:892
**Klingensmith, R.W.,** Experimental investigation of release mechanisms responsible for airborne contamination seen during post-transport underwater unloading of a failed PWR spent fuel assembly, 7:297 (INIS-mf—6447, pp vp)
**Klitzsch, E.,** *See* Sonntag, C., 7:1016
**Kloecker, N.,** *See* Wilhelm, K., 7:1378
**Kloesch, W.,** *See* Duftschmid, K.E., 7:952
**Klouda, G.A.,** *See* Cooper, J.A., 7:982
**Klygin, N.Ya.,** *See* Kiselevskii, L.I., 7:1464
**Klyuchnikov, N.I.,** Kinetic equation for electrons in metallic and gaseous

plasma with account for exchange effect, 7:1471
**Knauff, M.,** *See* Donten, K., 7:317
**Kneifl, M.,** Effect of long-term action of liquid sodium on resistance of steels 17346 and 17349 to low-cycle fatigue, 7:650 (INIS-mf—6423, pp vp)
**Knezovich, J.P.,** Influence of organic chelators on the toxicity of copper to embryos of the Pacific oyster, Crassostrea gigas, 7:1247
**Knipe, A.D.,** Gamma-ray energy deposition measurements in a heterogeneous core and their analysis, 7:395 (EUR—6813(Vol.2), pp 1188-1202)
**Knox, R.W.O'B.,** Stratigraphical relationships of Palaeocene sands in the UK sector of the central North Sea, 7:34
**Knudsen, P.,** Power ramp performance of vipac fuel, 7:490 (IWGFPT—8, pp 112-120)
**Ko, P.I.,** Vibrational and fretting wear of heat exchangers, 7:442 (AECL—6885, pp 1 - 7)
**Kobayashi, N.,** *See* Kaneko, Y., 7:1414
**Kobayashi, S.,** *See* Doke, T., 7:962
*See* Matsushima, H., 7:514
*See* Ogata, Y., 7:412
*See* Yoshioka, K., 7:276
**Kocbach, L.,** Alignment of ions after L- and M-shell ionization by proton impact, 7:1426
**Koch, L.,** Simultaneous multielement precision isotope analysis of nuclear fuel, 7:165
**Koch, L.W.,** *See* Koutoubi, S., 7:63
**Kodaira, K.,** Atmospheric structure of the low-temperature stars, 7:1370
**Koester, R.,** *See* Rudolph, G., 7:213
**Kogai, K.,** *See* Ichikawa, M., 7:501
**Kogan, I.A.,** Estrogen excretion in woman working for a long period of time with ionizing radiation sources, 7:1231
Functional state of adrenal glands of patients with endometrium cancer before and after radiotherapy, 7:1217
*See* Vusik, I.M., 7:1213
**Kohata, Y.,** Dynamic analyses and control systems for steam generators in LMFBRs, 7:424
**Koike, F.,** *See* Yagishita, A., 7:1404
**Koike, H.,** *See* Sakudo, N., 7:1387
**Kojima, M.,** *See* Washimi, H., 7:1362
**Kolesnikov, I.Ya.,** *See* Bochek, G.I., 7:1640
**Kolomeets, E.V.,** *See* Aitbaev, F.B., 7:1277
**Koltay, E.,** *See* Mukoyama, T., 7:1399
**Komaki, K.,** *See* Kawatsura, K., 7:1403
**Komar, I.N.,** Fundamentals of the theory of radiation impact processes in crystalline amino acids, proteins and quasiperiodic biological structures. Pt.2, 7:1142 (INIS-mf—6304, pp vp)
**Komarneni, S.,** Stability of pollucite in hydrothermal fluids, 7:705
**Komarov, V.I.,** Nucleon association effects in reactions at medium energies, 7:1589 (JINR—D-4-80-385, pp 337-356)
Proton-nucleus interactions at intermediate energies accompanied by fast proton backwards emission, 7:1570 (ITEF—129(1979), pp 24-25)
**Kominek, A.,** *See* Sojka, J., 7:973
**Komitowski, D.,** *See* Seidel, A., 7:1182
**Komura, K.,** Rare gas especially $^{41}Ar$ released from research nuclear reactor and its in-situ measurement, (1), 7:987 (KURRI-TR—179, pp 20-22)
**Kon, H.,** *See* Narita, M., 7:937
**Kon'shin, V.A.,** *See* Antsipov, G.V., 7:1601
**Kondal Rao, N.,** Aspects of large scale production of $UO_2$ pellets, 7:518
**Kondo, T.,** *See* Shindo, M., 7:681
**Kondrat'ev, R.L.,** *See* Dolbilkin, B.S., 7:1578
**Konecny, A.,** Testing induction pumps on KAS I facility and problems of safety of work in testing plant, 7:403 (INIS-mf—6423, pp vp)
**Kononeko, E.K.,** *See* Piskareva, E.V., 7:1212
**Kononenko, E.I.,** *See* Davydova, L.I., 7:1104
**Konstant, Z.A.,** *See* Gedrovits, Ya.Ya., 7:822
*See* Vaivada, M.A., 7:821
**Konter, A.W.A.,** Effect of biaxial loading and geometry on prediction of low-cycle fatigue life, 7:698
**Koomen, M.J.,** *See* Michels, D.J., 7:1348
*See* Sheeley, N.R. Jr., 7:1297
**Kopanets, E.G.,** *See* Kachan, A.S., 7:1584
**Kopeliovich, B.Z.,** Hadron-nucleus total cross sections in the quark-parton model, 7:1624 (TRI—79-1, pp 110)
**Kopp, E.,** Positive ion composition in noctilucent clouds, 7:1374 (ESA-SP—152, pp 117-118)
**Kopp, R.A.,** *See* Svestka, Z., 7:1322
**Koranda, J.,** *See* Clegg, B., 7:1007
**Korbion, H.,** Legal advantages for those complying with technical standards, 7:1715
**Korchemnaya, E.K.,** *See* Stepanov, A.V., 7:790, 7:823
**Korchevoy, Yu.P.,** *See* Antonov, E.E., 7:896
**Korchin, A.Yu.,** Electron quasi-free scattering by atomic nuclei in the interaction time approximation, 7:1560 (KFTI—79-48, pp 49-50)
*See* Berezovoj, V.P., 7:1577
*See* Ganenko, V.B., 7:1559
**Kornienko, V.V.,** *See* Mamotyuk, E.M., 7:1205
**Korsch, M.J.,** *See* Riley, G.H., 7:78
**Korthondiia, V.P.,** *See* Kervalishvili, N.A., 7:1457
**Kortus, J.,** Radionuclide accumulation in selected components of the aquatic fauna of the Czechoslovak Danube River section, 7:1042 (IAEA-TECDOC—229, pp 49-53)
**Kosareva, I.M.,** *See* Spitsyn, V.I., 7:215
**Koschienko, V.N.,** *See* Avrutskii, V.A., 7:1449
**Koshevaya, V.P.,** *See* Bovenko, V.N., 7:1140
**Koshkin, V.M.,** Instability zones of interacting point defects in the periodical structures, 7:1651 (KFTI—79-65, pp 21-26)
**Kosinski, W.,** Nonlinear endochronic theory of cylic plastic hardening and softening, 7:1664
**Koslik, S.,** Acute effect of haemodialysis on thyroid hormone level, 7:1111 (INIS-mf—6419, pp vp)
**Kost, J.A.,** Mine demonstrations of longwall dust-control techniques. Phase I status report, 7:4 (BCR-I—1245)
**Kostin, V.Ya.,** *See* Kachan, A.S., 7:1584
**Kostinik, I.M.,** *See* Shust, I.V., 7:1228
**Kostyuk, G.Ya.,** *See* Sukhorukov, B.Z., 7:1226
**Kosugi, T.,** Radio and x-ray observations of a multi-spike impulsive burst with high time resolution, 7:1367
**Kot, C.A.,** Shock and blast load attenuation in inertial confinement fusion reactors, 7:1689
**Kotlyar, L.M.,** *See* Vassileva, G.J., 7:1314
**Kotlyarevskii, D.M.,** Particle interactions with nuclei in the energy range of 0.1-5 TeV, 7:1568
**Kotov, V.I.,** *See* Garkusha, V.I., 7:909
**Koupil, M.,** *See* Cermak, Z., 7:2
**Koutoubi, S.,** Uranium in Niger, 7:63
**Koutsky, J.,** *See* Havel, S., 7:312
**Kovacs, K.L.,** Asymmetric crystal seeding in the presence of beta particles. Chapter 16, 7:843
**Kovalenko, G.D.,** *See* Bochek, G.L., 7:1640
**Kovar, C.,** *See* Docekal, J., 7:741
**Kowalewsky, H.,** Leak testing and activity leakage rate evaluation. Practical experiences, first approaches to some systemization and outstanding problems, 7:854 (INIS-mf—6447, pp vp)
*See* Heumos, K., 7:860
**Kozak, I.,** RIA properties of iodo-derivatives of methyl testosterone, 7:1057 (INIS-mf—6419, pp vp)
**Kozusko, R.G.,** Bernabe Montano uranium deposit, Sandoval County, 7:120
**Krakowski, R.A.,** *See* Cort, C.E., 7:1702
**Kral, J.,** *See* Jakes, D., 7:404
**Kramer, E.,** High cost of heat: a new threat to city neighborhoods, 7:636 (PAS—349, pp 11-16)
**Krasin, A.K.,** *See* Zenevich, V.A., 7:1602
**Kratochvil, J.,** Constitutive modelling in plasticity, 7:693
**Krauth, H.,** Fracture toughness of nitrogen strengthened austenitic steels at 4K, 7:674
**Krautwasser, P.,** *See* Herren, M., 7:169
**Krawczyk, M.,** Production of real photons, leptons and hadrons in hadron-hadron collisions, 7:1522
**Krechetov, Yu.F.,** *See* Eponeshnikov, V.N., 7:1574
**Kreisler, M.N.,** *See* Wise, J., 7:1487
**Kretschmer, F.,** Standards and producers' liability, 7:1713
**Krieg, R.,** *See* Ludwig, A., 7:582
**Krieger, E.,** *See* Hartwig, S., 7:176
**Krishnan, M.S.,** *See* Jayaprakash, T., 7:781
**Krishnasamy, S.G.,** Structural beam shapes under cyclic inelastic loads, 7:469
**Krivonosov, G.A.,** *See* Gorenko, A.F., 7:743
**Krivonosov, M.V.,** *See* Mikhajlov, P.A., 7:1223
**Krivy, J.,** Comparison of response spectra for aircraft impact calculated by a beam-mode and a 3D-shell-model, 7:586
**Krohn, B.J.,** *See* McDowell, R.S., 7:829
**Krupchitskaya, K.I.,** *See* Livergant, Yu.E., 7:1103
**Krupennikova, N.B.,** *See* Dzhibuti, R.I., 7:1562
**Krupke, W.F.,** Advanced lasers for fusion, 7:1676
**Kselikova, M.,** Methodology of HBsAg, HBsAb and vitamin B 12 concentration determination by RIA, 7:1065 (INIS-mf—6419, pp vp)

*See* Novak, J., 7:1064
**Kubicek, P.,** Radiometric determination of bulk density of suspensions by the absorption method, 7:972 (INIS-mf—6422, pp vp)
**Kubota, J.,** Hydrodynamic stability tests and analytical model development for once-through sodium heated steam generator, 7:420
**Kubota, K.,** *See* Ito, S., 7:1402
**Kudin, A.T.,** Thrombelastographic indices in patients with syringomyelia treated with radioactive iodine, 7:1241
**Kudlickova, Z.,** *See* Svobodova, M., 7:1113
**Kudo, A.,** *See* Mahara, Y., 7:1046
**Kudo, H.,** Surface analyses of GaAs by ion beam backscattering method, 7:1429
*See* Ihle, H.R., 7:1680
**Kudo, S.,** Etching conditions and shape of tracks. Continuous etching with HF of 5, 10, 20 and 46%, 7:938 (KURRI-TR—190, pp 39-42)
**Kuhl, D.E.,** *See* Hoffman, E.J., 7:1118
**Kuhn, S.,** Iterative method for computing velocity distribution functions of low-concentration particle components in a given non-uniform background, 7:1472
**Kulakov, V.M.,** Measurements and evaluations of nuclear data on actinide isotopes. Review of papers published by Soviet scientists during 1975-1978, 7:1597 (INDC(CCP)—135/LN, pp 11-22)
*See* Zhudov, V.I., 7:1599, 7:1600
**Kulcar, L.,** *See* Letfus, V., 7:1296
**Kulcinski, G.L.,** *See* Abdel-Khalik, S.I., 7:1685
*See* McCarville, T.J., 7:1703
**Kulibaba, V.I.,** *See* Bochek, G.L., 7:1640
**Kulish, Yu.V.,** Polarization effects in the $\gamma d \rightarrow np$ reaction and D* resonances, 7:1558 (KFTI—79-48, pp 66-69)
**Kumar, K.,** Relation between mobility and diffusion in swarms, 7:1469
**Kumar, R.,** *See* Weisner, R.H., 7:1073
**Kundu, M.R.,** *See* Gergely, T.E., 7:1328
**Kung, A.H.C.,** *See* Lehrbach, P.R., 7:1155
**Kunieda, H.,** *See* Hayakawa, S., 7:1366
**Kuntze, W.M.,** *See* Krivy, J., 7:586
**Kunz, H.,** Percolation processes, 7:1646 (INIS-mf—6084, pp vp)
**Kupfer, M.J.,** *See* Schulz, W.W., 7:199
**Kurbatov, A.A.,** Magnetic field effect upon maintenance of continuous optical discharge in gases, 7:1479
**Kurepin, A.B.,** Pion-nucleus interaction and nuclear structure (experiment), 7:1616 (JINR-D—4-80-385, pp 168-188)
**Kuribayashi, H.,** *See* Tokubuchi, T., 7:208
**Kurkchi, N.A.,** *See* Ivanitskaya, V.I., 7:1214
**Kurochka, L.N.,** Emission energy of optical solar flares of different power, 7:1285 (INIS-mf—6385, pp 158)
**Kuroda, K.,** *See* Muto, K., 7:378, 7:596
**Kurosawa, R.,** Application of solid state track detector as an alpha-ray detector, 7:940 (KURRI-TR—190, pp 57-60)
**Kurosawa, T.,** *See* Sasaki, Y., 7:731
**Kuszpet, M.E.,** Calibration of radiation protection instruments at SSDL level in Israel, 7:959
**Kutilin, S.A.,** *See* Shamov, A.I., 7:769
**Kuwabara, Y.,** *See* Takemori, T., 7:588
**Kuwako, A.,** *See* Kamiya, M., 7:1415
*See* Sera, K., 7:1400
**Kuzelka, V.,** Vibration of PWR internals considering their edge conditions and holes, 7:320
**Kuzhevskii, B.M.,** *See* Vakulov, N.V., 7:1278
**Kuzmenko, P.J.,** *See* Annen, K.D., 7:634
**Kuznetsova, M.A.,** *See* Vassileva, G.J., 7:1314

## L

**La Padula, C.,** *See* Ubertini, P., 7:948
**LaBonte, B.J.,** Search for giant cells in the solar convection zone, 7:1290
*See* Moore, R.L., 7:1320
**Laboudigue, J.F.,** *See* Bordet, R., 7:316
**Lacombe, M.,** Paris potential and recent observables, 7:1528 (IPNO-TH—80-49, pp 1-13)
**Lafitte, R.,** Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.1. Design of the multi-cavity prestressed concrete reactor vessel with warm liner, 7:333 (IWGHTR—2, pp 15-33)
**Laflen, J.H.,** *See* Leis, B.N., 7:694
**LaFleur, P.D.,** *See* Becker, D.A., 7:758
**Lafon, A.,** *See* Bon Mardion, G., 7:427
**Lafuma, J.,** Combined carcinogenic effects of ionizing radiation and chemical molecules, 7:1197
**Lafuma, J.E.,** *See* Morin, M.E., 7:1193
**Lagar'kov, A.N.,** Study of the dense weakly ionized mercury plasma by the method of molecular dynamics, 7:1476
**Lagerlund, T.D.,** *See* Larwill, M., 7:914
**Lakiza, L.V.,** *See* Simonova, L.I., 7:1209
**Lalet, A.,** *See* Lambert, I., 7:816
**Lalu, P.,** *See* Briot, F., 7:1186
**Lam-Po-Tang, R.,** *See* Vowels, M.R., 7:1084
**Lama, R.D.,** Drainage of methane from the solid at West Cliff Colliery. Part 1. Optimization of drainage hole design parameters, 7:8
Use of adsorption/desorption isotherms in predicting outburst conditions, 7:6
**Lambert, I.,** Thermodynamics of magnetite solubilization in basic medium, 7:816
**Lang, C.,** *See* Ainscough, J.B., 7:484
**Lang, E.K.,** Transcatheter embolization of renal neoplasms. A comparison of the merits of the radio-active infarct implant versus total embolization with inert material, 7:1176
**Lang, H.,** UV radiation effects on molecular and cellular systems. Chapter 3.1, 7:1179
**Lange, F.,** Implications of the new limits for intake (ICRP 26 and ICRP 30: on the $A_1$ and $A_2$ values, 7:179 (INIS-mf—6447, pp vp)
**Langford, F.F.,** Stratigraphic implications of uranium deposits, 7:101
**Lanning, D.D.,** *See* Nicholson, P.J., 7:523
**Lanza, S.,** In situ and laboratory testing of iodine filters in Italy, 7:565
**Lapidus, L.I.,** *See* Kopeliovich, B.Z., 7:1624
**Larker, H.T.,** Treatment of cladding hulls by the HIPOW process, 7:207
**Larsen, E.M.,** *See* Abdel-Khalik, S.I., 7:1685
**Larwill, M.,** UNIBUS processor interface for a FASTBUS data acquisition system, 7:914
**Lascaux, P.,** *See* Absi, E., 7:571
**Laschka, D.,** *See* Huebel, K., 7:1037
**Latorre, D.C.,** *See* Payne, B.R., 7:1018
**Latrobe, A.,** Comparison of some implicit finite difference schemes used in flow boiling analysis, 7:903
**Lauffenburger, T.,** *See* Auf der Maur, A.N., 7:955
**Lavery, N.G.,** *See* Moore, S.C., 7:145
**Lavin, M.,** Role of ultraviolet light in bovine ocular squamous cell carcinoma (BOSCC:, 7:1148 (INIS-mf—6531, pp vp)
*See* Ford, M., 7:1245
**Lawrence, C.R.,** Proceedings of the groundwater pollution conference, Perth, Western Australia, Feburary 19-23, 1979, 7:232
**Lawrence, E.J.,** *See* Keiser, J.R., 7:678
**Lawrence, L.A.J.,** *See* Bainbridge, A., 7:426
**Lay, G.,** *See* Fahr, H.J., 7:1311
**Lazard, C.,** Reaction mechanisms in coherent nuclear photoproduction, 7:1591 (IPNO-TH—80-49, pp 1-17)
**Le Dieu de Ville, A.,** *See* Alberman, A., 7:289
**Le Goux, J.J.,** TSN 206 SA thermal ionisation mass spectrometer and its applications to Oklo natural fossil reactor studies, 7:787
**Le Marois, G.,** *See* Musikas, C., 7:850
**Leal, J.M.,** *See* Salati, E., 7:1019
**Lebey, J.,** *See* Bethmont, M., 7:327
**Leblanc, P.,** *See* Vialettes, H., 7:623
**LeBritton, J.,** *See* McCal, D., 7:1499
**Lecarpentier, P.,** Structural analysis of a PWR vessel nozzle-to-hemisphere, 7:315
**Ledovskoy, V.P.,** Ion focusing of overneutralized electron beams in metal vapour, 7:1463
**Lee, B.T.,** *See* Lehrbach, P.R., 7:1155
**Lee, B.T.O.,** *See* Direkze, C.D., 7:1156
*See* Lehrbach, P.R., 7:1157
**Lee, L.H.N.,** *See* Ng, D.H.Y., 7:697
**Lee, R.R.,** Review of ANS special session on radiation streaming in power reactors, 7:296 (EUR—6813(Vol.2), pp 928-936)
**Lee, Y.H.,** *See* Kang, Y.H., 7:762
**Leech, W.J.,** Effects of fission gas release on PWR fuel rod design and performance, 7:299 (IWGFPT—7, pp 173-179)
**Leenhouts, H.P.,** Analytical approach to the comparison of chemical and radiation hazards to man, 7:1200
**Lefevre, J.,** *See* Philippot, J.C., 7:946
**Lehman, D.R.,** *See* Gibson, B.F., 7:1626
**Lehnert-Thiel, K.,** *See* Kirchner, G., 7:89
**Lehrbach, P.R.,** Mechanisms of radiation induced mutability in bacteria, 7:1157 (INIS-mf—6531, pp vp)
Plasmid modification of spontaneous and radiation-induced mutability in Pseudomonas aeruginosa, 7:1158 (INIS-mf—6531, pp vp)
R-plasmid mediated repair in Pseudomonas aeruginosa, 7:1155 (INIS-mf—6531, pp vp)
*See* Direkze, C.D., 7:1156
**Leigh, D.,** *See* Moyes, H.J., 7:789

**Leis, B.N.,** Damage postulate for nonproportional cyclic plasticity, 7:694
**Leishman, J.,** *See* Simpson, C.J., 7:1256
**Leissner, M.,** *See* Bienlein, J.K., 7:1496
**Leith, D.W.G.,** *See* Stroynowski, R., 7:1488
**Lejeune, C.,** Improvement of multiply charged ion production for pulsed duoplasmatron of duoPIGatron, 7:1393
*See* Gilles, J.P., 7:1389
**Lemercier, M.,** *See* Geffroy, J., 7:406
**Lemesch, C.,** *See* Tadmor, J., 7:632
**Lemmon, R.M.,** Radioracemization of amino acids. Chapter 4, 7:837
**Lemon, G.J.,** Role of bone in calcium ion homeostasis: studies with indicator-dilution methods, 7:1078
**Lempert, G.D.,** *See* Chavet, I., 7:908
**Lenders, H.,** *See* Mathieu, F., 7:929
**Leonard, F.,** *See* Mathieu, F., 7:929
**Leridon, A.,** Plastic instability of Zircaloy cladding submitted to LOCA conditions, 7:585
**Lerner, E.J.,** EMPs and nuclear power, 7:556
**Lerner, U.,** Delayed stimulatory effect of cyclic AMP on bone resorption, 7:1075
**Leroy, B.,** *See* Bel, N., 7:1305
**Lesh, G.C.,** *See* Boukamp, B.A., 7:607
**Letfus, V.,** Possibility of identifying coronal holes on synoptic maps of the green corona, 7:1296
**Lethert, E.K.,** Design, construction and pressure test of a PCIV gas storage vessel for the THTR-300, 7:375
**Leung, K.N.,** Low-energy ion beam transport by permanent magnets, 7:911
**Levay, B.,** Information on the state of electrons in liquids from positronium formation data, 7:1435
**Leventhal, J.S.,** Organic geochemistry and uranium in Grants mineral belt, 7:103
**Levin, M.,** Precipitation, flood- and groundwaters of the Negev Highlands. An isotopic study of desert hydrology, 7:1011
**Levine, R.H.,** Evolution of coronal and interplanetary magnetic fields, 7:1288
**Levinson, S.,** *See* Carmon, B., 7:775
**Lewinson, D.,** *See* Eilam, Y., 7:1074
**Lewis, S.,** Environmental isotope balance of Lake Kinneret as a tool in evaporation rate estimation, 7:1009
**Lewry, J.F.,** *See* Hoeve, J., 7:87
**Leyden, M.,** Frameshift mutagenesis by ultraviolet and gamma radiation, 7:1159 (INIS-mf—6531, pp vp)
**Lezana, A.H.,** *See* Casanova, R., 7:1096
**Lhermenier, A.,** Refurbishing of the hot cell Celimene for the post-irradiation examination of PWR assemblies, 7:864
**Lichoded, A.K.,** *See* Kartvelishvili, V.G., 7:1519, 7:1520
**Lichtenstein, M.,** *See* Admon, U., 7:974
**Lien, J.R.,** *See* Rekstad, J., 7:1588, 7:1595
**Likin, O.B.,** *See* Val'nichek, B.I., 7:1286
**Lilley, R.J.,** *See* Campbell, D.A., 7:410
**Lin, C.W.,** Seismic response analysis of nuclear power plant auxiliary mechanical equipment, 7:590
**Lindberg, R.,** *See* Runnells, D.D., 7:148
**Lindsay, R.,** Quantitative 99mTc-diphosphonate whole body retention, plasma PTH and bone loss in oophorectomized women, 7:1076
**Link, R.L.,** *See* Kelly, T.E., 7:233
**Linvill, M.L.,** *See* Skvarla, M.F., 7:197
**Lipkin, H.J.,** Microscopic structure and group theory of the interacting boson model, 7:1627
**Lipowicz, M.A.,** *See* Arbo, J.C., 7:638
**Lippens, M.,** *See* Haas, D., 7:500
**Lippincott, E.P.,** *See* Gold, R., 7:293
**Lisin, V.P.,** *See* Dolbilkin, B.S., 7:1578
**Little, E.A.,** *See* Fraser, A.S., 7:414
**Litvinov, E.A.,** Processes at cathode operating in regime of electron explosive emission, 7:1445
**Liu, K.F.,** Meson spectra, 7:1501 (TRI—79-1, pp 74)
**Liu, T.H.,** Analysis and design of containment liner/anchorage system, 7:330
**Liukkonen, E.,** *See* Rekstad, J., 7:1588
**Livergant, Yu.E.,** Changes in the level of thyrotropic hormones of hypophysis of radioiodinetherapy of thyrotoxicosis, 7:1103
**Livingston, B.A. Jr.,** Geology and development of Marquez, New Mexico, uranium deposit, 7:143
**Lloyd, J.W.,** Aspects of the environmental isotope chemistry in groundwaters in Eastern Jordan, 7:1023
Conceptual hydrochemical model for alluvial aquifers on the Saudi Arabian basement shield, 7:1024
Examination of recharge mound decay and fossil gradients in arid regional sedimentary basins, 7:1015
**Lo, S.,** *See* Chang, C., 7:1510
**Loceff, F.,** *See* Liu, T.H., 7:330
**Lockwood, G.W.,** Correlated variations of planetary albedos and solar-interplanetary parameters, 7:1313
**Loeb, H.W.,** *See* Freisinger, J., 7:1438
**Loevhoeiden, G.,** *See* Rekstad, J., 7:1588, 7:1595
**Lokhvitskaya, M.V.,** *See* Kogan, I.A., 7:1217
**Lomakin, M.M.,** *See* Lutsenko, S.M., 7:1115
**Lomanno, F.,** *See* Wise, J., 7:1487
**Lomon, E.,** Joining the quark theory to the hadron exchange theory of interactions, 7:1529 (IPNO-TH—80-49, pp 1-15)
**Lomsky, R.,** *See* Cerman, J., 7:1059
*See* Suba, P., 7:1058
**Long, E.L.,** *See* Robbins, J.M., 7:747
**Lopez Vilchez, J.,** *See* Soler, R., 7:52
**Lorenc, P.,** *See* Horsky, J., 7:1661
**Lossel, P.,** *See* Heritier, F.E., 7:55
**Low, B.C.,** False equilibrium of a force-free magnetic field, 7:1333
**Lowe, D.B.,** *See* Moody, B.R., 7:872
**Lowe, D.W.,** *See* Moody, B.R., 7:872
**Lowenthal, J.W.,** Response of cultured mouse lymphoid cell lines to x-irradiation, 7:1145 (INIS-mf—6531, pp vp)
**Lowry, R.M.,** *See* Baird, C.W., 7:121
*See* Hicks, R.T., 7:115
**Lozinskaya, I.N.,** *See* Livergant, Yu.E., 7:1103
**Ludwig, A.,** Calculations on the HDR core barrel response during snapback tests, 7:584
Dynamic behavior of a PWR-core barrel. Analytical integration of the cylindrical shell equations, 7:582
*See* Schumann, U., 7:579
**Lueck, S.L.,** *See* Runnells, D.D., 7:148
**Luensmann, W.,** *See* Huebel, K., 7:1037
**Lugovskaya, K.A.,** *See* Zhidovtseva, M.I., 7:1216, 7:1240
**Luk'yanov, V.K.,** Possibility of multiquark configuration existence in nuclei, 7:1615 (JINR—D-4-80-385, pp 357-376)
**Lukashenko, V.I.,** *See* Antonov, E.E., 7:896
**Lukashova, O.P.,** Fractional composition of sulfurmucoids in rats at acute radiation sickness, 7:1206
Serum-mucoid fraction content in development of skin acute radiation necrosis in rats, 7:1224
*See* Mamotyuk, E.M., 7:1208, 7:1225
**Lukesova, S.,** *See* Kozak, I., 7:1057
**Lunde, L.,** Influence of environmental variables and irradiation on iodine stress corrosion crack initiation and growth in Zircaloy, 7:653 (IWGFPT—7, pp 9-16)
Stress corrosion testing of irradiated Zircaloy cladding and its relevance to PCI failure, 7:492 (IWGFPT—8, pp 160-169)
**Lundin, R.,** *See* Eliasson, L., 7:1377
*See* Sandahl, I., 7:1376
**Lupe, R.,** *See* Finch, W.I., 7:130
**Lutes, I.G.,** Operating experience with a fluidized bed steam generator at Georgetown University, 7:905 (CONF-8004173—11)
**Lutsenko, S.M.,** Method of radioisotopic indication with chromium-51 in the evaluation of circulating blood volume in persons of different age, 7:1115
**Luttke, A.,** *See* Bonotto, S., 7:1192
**Lutze, W.,** *See* Altenhein, F.K., 7:717
**Lydie, B.,** *See* Zdenek, K., 7:454
**Lyford, F.P.,** Preliminary estimates of effects of uranium-mine dewatering on water levels, San Juan Basin, 7:234
**Lynn, J.E.,** Fission barrier theory and its application to the calculation of actinide neutron cross-sections, 7:1614 (IAEA-SMR—43, pp 353-415)
**Lysenko, V.,** *See* Cech, V., 7:401

## M

**Macau, J.P.,** *See* Gardier, S., 7:949
**MacDonald, D.D.,** *See* McKubre, M.C.H., 7:639
**Macek, J.,** Alignment and orientation in atomic collisions, 7:1421
**Macek, M.,** *See* Dvorak, P., 7:1112
**MacEwen, S.R.,** *See* Causey, A.R., 7:389
**MacGregor, J.G.,** *See* Rizkalla, S., 7:388
**Machanova, Y.,** *See* Koslik, S., 7:1111
**Machiels, A.J.,** Influence of surface processes in waste form leaching, 7:214
**Mackay, J.,** *See* McKavanagh, B.M., 7:5
**MacLaughlin, J.,** *See* Holick, M.F., 7:1173
**MacPhee, D.G.,** How real is the environmental mutagenesis threat, 7:1165 (INIS-mf—6531, pp vp)
Mutagenesis by technetium-99 and by chemicals, 7:1168 (INIS-mf—6531, pp vp)
*See* Leyden, M., 7:1159

**Maddalena, D.J.,** In vitro studies of the cellular transport of radioactive caesium-134m in rat thyroid tissue, 7:1167 (INIS-mf—6531, pp vp)
**Madhava, M.R.,** *See* Bandyopadhyay, A.K., 7:1654
**Maene, N.,** *See* Tourwe, H., 7:930
**Maenner, R.,** *See* von Harrach, D., 7:1603
**Mahapatra, D.P.,** *See* Sen, P., 7:777
**Mahara, Y.,** Mobility and retention of $^{60}$Co in soils in coastal areas, 7:1046
**Mahaux, C.,** Theoretical aspects of the optical model, 7:1605 (IAEA-SMR—43, pp 97-120)
**Maher, C.E.,** Piper oilfield, 7:43
**Mai, V.,** *See* Coehinal, R., 7:951
**Maier, G.,** Mathematical programming methods in engineering plasticity, 7:1665
**Maiwald, W.,** *See* Basler, W.D., 7:730
**Makarov, V.A.,** *See* Bibikova, E.V., 7:1271
**Maki, Y.,** *See* Nagakura, T., 7:174
**Makino, Y.,** *See* Asada, Y., 7:664
**Maksimenko, N.V.,** *See* Afonin, A.A., 7:1622
**Malakhov, I.Ya.,** Definition of absolute differential cross sections in the case of using many-component targets, 7:1620 (KFTI—79-40, pp 15)
**Malen, K.,** Comparison of grain growth measurements and predictions for fuel rods S176-6, -7, -8, and -9, 7:482 (IWGFPT—7, pp 196-210)
**Malinovskij, E.I.,** *See* Belousov, A.S., 7:1576
**Mallarini, G.,** *See* Oliva, L., 7:1090
**Malow, G.,** Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
*See* Altenhein, F.K., 7:717
**Mameghan, H.,** *See* Vowels, M.R., 7:1084
**Mamotyuk, E.M.,** Metabolism breakage of non-collagenous proteins and skin ultrastructure of rats in case of its local radiation acute injury, 7:1225
Relation of mucoprotein metabolism with radiosensitivity of rat organism exposed to ultraviolet radiation, 7:1205
Study on fractional composition of serous and tissue mucoproteins in rats in norm and at acute radiation sickness, 7:1208
*See* Markov, V.I., 7:1229
**Mandelkern, L.R.,** *See* Smith, D.W., 7:1486
**Mangal, P.C.,** Trace element concentrations in human hair: a study by instrumental neutron activation analysis, 7:778
**Mangeney, A.,** *See* Couturier, P., 7:1304
*See* Dobrowolny, M., 7:1308
**Mangusi, J.,** It's a mad mad world, 7:182 (INIS-mf—6447, pp vp)
**Manjunath, C.V.,** Single klystron superhet, E.S.R. spectrometer for low level and low frequency modulation, 7:971
**Manley, I.T.,** Non-proliferation. A political problem, 7:620
**Mann, A.W.,** *See* Deutscher, R.L., 7:99
**Mann, S.A.,** Management of sodium-bearing transuranic waste and scrap materials, 7:192
**Manninen, M.,** *See* Nieminen, R.M., 7:1434
**Mansfeld, A.,** Methodology used for the study of sorption properties of bottom sediments and some basic information on the behaviour of selected radionuclides in aqueous media, 7:1036 (IAEA-TECDOC—229, pp 41-48)
**Mansour, M.N.,** Development of a low NO/sub x/ burner for utility boilers, 7:845 (CONF-800608—(Vol.3), pp 23p, Paper 5)
**Mantel, M.,** X-ray spectrometry. Chapter 3. Section 2, 7:749
*See* Amiel, S., 7:751
**Manzel, R.,** *See* Francke, K.P., 7:508
**Maples, G.C.,** Design of a real-time software system for the distributed control of power station plant, 7:525 (AECL—7056, pp 32-42)
**Mar, R.,** Application of reversible chemical reactions to solar thermal energy systems, 7:270
Materials science issues encountered during the development of thermochemical concepts, 7:819
**Marcaillou, J.,** Experience of management of plutonium-contaminated solid and liquid wastes at the Cadarache Nuclear Research Centre, 7:191
**Marchand, J.D.,** *See* Lafitte, R., 7:333
**Marega, I.N.,** Diagnostic value of radioisotopic methods of study in liver diseases, 7:1100
**Mares, S.,** Nuclear logging methods, 7:977
**Markandeya, S.G.,** Parametric study of the temperature differential across the wall of an underground storage vault for monitored storage of radioactive wastes, 7:225
**Markos, G.,** *See* Runnells, D.D., 7:148
**Markov, V.I.,** Some peculiarities of ultrastructural changes of bone marrow myeloid and erythroid sprouts of rats in acute radiation injury, 7:1229
*See* Mamotyuk, E.M., 7:1225
*See* Piskareva, E.V., 7:1212
**Markytan, M.,** Particle production in anti pp annihilation and non-annihilation, 7:1515
**Marques, F.D.S.,** $\beta/\alpha$ phase transformation in zirconium and certain zirconium based alloys, 7:644
**Marsden, M.E.,** *See* Kaiser, E.J., 7:637
**Marsh, C.A.,** *See* Maddalena, D.J., 7:1167
**Marshall, M.,** *See* Stroynowski, R., 7:1488
**Marston, T.U.,** *See* Stahlkopf, K.E., 7:456
**Martin, A.,** Experimental studies of PWR secondary piping in case of steam break, 7:328
Potential models of new particles, 7:1543
**Martin, J.P.,** *See* DeVoto, R.H., 7:149
**Martin, K.W.,** *See* Baird, C.W., 7:121
**Martin, S.F.,** *See* Svestka, Z., 7:1322
**Martres, M.J.,** *See* Schmieder, B., 7:1321
**Martynenko, M.E.,** *See* Gokhfeld, D.A., 7:692
**Martynov, A.D.,** *See* Selivanov, V.M., 7:453
**Martynov, A.I.,** *See* Petrusenko, Yu.T., 7:247
**Maruyama, T.,** *See* Ireland, D.R., 7:690
**Marwick, A.D.,** 200kV heavy-ion accelerator for radiation damage research and its use for studies of radiation-enhanced diffusion and segregation, 7:920
**Masek, V.,** Simulating thermodynamic effects in liquid sodium reactor facilities using electrically heated fuel element mock-ups, 7:400 (INIS-mf—6423, pp vp)
*See* Sulc, V., 7:399
**Mashkarova, V.G.,** *See* Khorenko, V.K., 7:450
**Maslov, V.M.,** *See* Antsipov, G.V., 7:1601
*See* Zenevich, V.A., 7:1602
**Massera, G.E.,** Passive monitor for radon using electrochemical track etch detector, 7:957
**Masson, D.G.,** *See* Roberts, D.G., 7:51
**Massoud, F.I.,** Contribution of the Land and Water Development Division of FAO to soil and water conservation in developing countries, 7:1129 (IAEA-TECDOC—236, pp 147-153)
**Mast, J.,** *See* Van de Velde, J., 7:883
**Mastropietro, M.,** *See* Ubertini, P., 7:948
**Masuda, K.,** *See* Kudo, H., 7:1429
**Masuda, M.,** Dynamic and static structural analysis of liquid lithium blanket of fusion power plants, 7:1698
**Matera, R.,** Applications of metallic composites in the magnet system of a demonstration fusion reactor, 7:1681
**Mathews, C.K.,** Application of thermal ionization mass spectrometry in nuclear technology, 7:779
**Mathieu, F.,** Thermoelectric neutron dosimetry: summary of recent results, 7:929 (EUR—6813(Vol.2), pp 1203-1219)
**Mathur, V.S.,** Unitary pole approximation, 7:1634
**Matolin, M.,** Radiometric and nuclear geophysics methods, 7:976
**Matsuda, S.,** *See* Murase, H., 7:682
**Matsui, E.,** *See* Salati, E., 7:1019
**Matsumoto, T.,** Comprehensive post-irradiation examination of power reactor fuels and core component materials, 7:880
*See* Hayakawa, S., 7:1369
**Matsushima, H.,** Application of the linear accelerator to radiographic inspection of irradiated fuel elements, 7:514
**Matsushima, Y.,** *See* Ohuchi, A., 7:283
**Matthes, W.,** Iterative multigroup cross-section adjustment procedure, 7:452
**Matthews, J.R.,** Ballooning of cladding tubes, 7:487 (IWGFPT—7, pp 267-276)
Simple treatment of fission gas for normal and accident conditions, 7:471 (IWGFPT—7, pp 36-44)
**Matthews, P.C.,** *See* Pritchard, J.A., 7:368, 7:841
**Matthews, R.W.,** Ceric dosimetry in radiation biology, 7:934 (INIS-mf—6531, pp vp)
**Mattila, I.J.,** Evaluation of gas release modelling approaches as to their applicability in fuel behaviour models, 7:477 (IWGFPT—7, pp 118-123)
**Mattsson, S.,** *See* Holm, E., 7:1048
**Matus, L.,** Low concentration spectroscopic standards by ion implantation, 7:768
**Matyushko, R.P.,** *See* Viktorov, A.P., 7:1082, 7:1120
**Matzke, M.,** Unfolding by least-squares methods: SAND-II, STAY'SL, 7:434 (EUR—6813(Vol.2), pp 721-731)
**Maurer, W.,** *See* Erb, J., 7:1692
**Maurya, A.L.,** Etch induction time in diacel plastic track detector, 7:966

**Maxwell, A.,** Radio data and computer simulations for shock waves generated by solar flares, 7:1329
**Maynard, C.W.,** *See* Abdel-Khalik, S.I., 7:1685
**Mays, C.W.,** RBE of α-particles versus β-particles in bone sarcoma induction, 7:1185
**Mazul, I.V.,** Calculation model and design principles of the demonstration Tokamak-reactor vacuum system, 7:1679
**Mazyrova, L.K.,** *See* Shapiro, A.L., 7:1451
**Mazzarella, C.,** *See* Polizzotto, C., 7:1667
**Mazzini, M.,** *See* Lanza, S., 7:565
**McAffer, N.T.C.,** *See* Bainbridge, A., 7:426
**McAndrew, J.,** Nature and significance of the occurrence of uranium in the Nanambu Complex of the Pine Creek Geosyncline, 7:74
*See* Binns, R.A., 7:85
**McCal, D.,** Evidence for scale breaking of the pion structure function, 7:1499
**McCammon, R.B.,** *See* Finch, W.I., 7:130
**McCardle, J.C.,** *See* Galpin, J.V., 7:244
**McCarroll, R.,** Charge exchange with multicharged ions in slow collisions. Translation factors in a quantum mechanical formulation, 7:1413
**McCarthy, G.J.,** *See* Davis, D.D., 7:704
*See* Roy, R., 7:206
**McCarville, T.J.,** Response of stainless steel to the pellet debris in a laser fusion reactor, 7:1703
**McClure, J.J.,** Plasma centrifuge I: Uranium partial pressure distributions, 7:161
**McClymont, A.N.,** Radiative hydrodynamics of flares: preliminary results and numerical treatment of the transition region, 7:1339
**McConnell, P.,** *See* Wullaert, R.A., 7:292
**McCracken, A.K.,** Analysis of the Winfrith iron benchmark experiment with DUCKPOND and comparison with the ANISN/SWANLAKE analysis, 7:440
Few-channel unfolding in shielding - the SENSAK code, 7:1638 (EUR—6813(Vol.2), pp 732-742)
*See* Hall, M.C.G., 7:308
**McDowell, R.S.,** High-resolution spectroscopy of the 16-μm bending fundamental of $CF_4$, 7:829
**McElroy, W.N.,** *See* Gold, R., 7:293
**McGarry, E.D.,** Dosimetry characterization of a reactor pressure vessel simulator by fission chamber and foil activation measurements, 7:926 (EUR—6813(Vol.2), pp 1031-1042)
*See* Eisenhauer, C.M., 7:295
**McGinley, F.E.,** Potential by-product uranium production in the United States of America, 7:157
**McIntosh, P.S.,** Dynamics of large-scale magnetic field evolution during solar cycle 20, 7:1291
**McKavanagh, B.M.,** Evaluation of the microseismic technique for outburst warning at West Cliff Colliery, 7:5
**McKee, F.,** *See* Cross, M.T., 7:512
**McKellar, B.H.J.,** *See* Ellis, R.G., 7:1508
*See* Miller, R.D.C., 7:1507
**McKercher, H.G.,** Ionized calcium concentrations in Krebs-Ringer bicarbonate buffers (KRBB) and their effect on mineral transport across intestinal mucosa and placenta, 7:1079
**McKubre, M.C.H.,** Dissolution and passivation of zinc in concentrated aqueous hydroxide, 7:639
**McLennan, S.M.,** Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
**McMinn, A.,** *See* Johnson, R., 7:660
**McNeil, T.,** Impact of data highway architectures on control and instrumentation design, 7:532 (AECL—7056, pp 156-166)
**McVay, G.L.,** Surface analysis: its uses and abuses in waste form evaluation, 7:716
**McWilliams, A.S.F.,** *See* Colley, M.G., 7:57
**Mead, R.H.,** *See* DeVoto, R.H., 7:149
**Mechali, D.,** Inhalation of radon and its daughter products. Doses and pathological effects, 7:1201
**Medici, G.,** *See* Ubertini, P., 7:948
**Medvedev, V.A.,** *See* Fuger, J., 7:847
**Mehner, A.-W.,** *See* Thiele, B.A., 7:352
**Mehner, A.W.,** *See* Herren, M., 7:169
**Mehrotra, R.S.,** *See* Rajagopalan, P.P., 7:519
**Mehta, G.K.,** *See* Sen, P., 7:777
**Mehta, S.K.,** *See* Anand, A.K., 7:497
**Mei, T.Y.C.,** Monitoring of environmental radon-222 in selected areas of Taiwan Province of the Republic of China, 7:994
**Meier, R.,** *See* Mathieu, F., 7:929
**Mein, P.,** *See* Schmieder, B., 7:1321
**Mel'nik, Yu.P.,** *See* Berezovoj, V.P., 7:1577
**Mel'nikova, S.M.,** Nature of cell composition of spleen in cancer of different localization after radiotherapy, 7:1215
**Melimuka, A.I.,** *See* Romas', R.S., 7:1116
**Melin, P.H.,** *See* Bruet, M., 7:302
**Melissions, A.C.,** *See* McCal, D., 7:1499
**Melling, P.J.,** *See* Karkhanis, S.N., 7:202
**Melrose, D.B.,** Relativistic effects in cyclotron instabilities, 7:1673 (INIS-mf—6424, pp vp)
**Membrillera, J.R.,** *See* Serrano, J.R., 7:152
**Menat, M.,** *See* Chavet, I., 7:908
**Menil, R.,** *See* De Leeuw, S., 7:444
**Menon, K.R.,** *See* Vartak, D.G., 7:784
**Menon, S.,** Development and testing of a liner venting system, 7:555 (IWGHTR—2, pp 114-125)
**Mercandalli, L.M.,** *See* Barcz, A., 7:772
**Mercier, F.,** *See* Bosser, M., 7:314
**Mercier, J.,** *See* Briot, F., 7:1186
**Mercier, P.,** Hierarchy of essential CANDU reactor control functions in a distributed system, 7:537 (AECL—7056, pp 265-281)
**Merdinger, J.C.,** *See* Beck, F., 7:1592
**Merren, T.O.,** *See* Haines, C., 7:788
**Merritt, W.F.,** *See* Pickens, J.F., 7:1045
**Merta, J.,** *See* Svoboda, V., 7:649
**Messelt, S.,** *See* Rekstad, J., 7:1595
**Messemer, G.,** *See* Erb, J., 7:1690
**Mesyats, G.A.,** *See* Litvinov, E.A., 7:1445
**Metcalf, W.,** *See* McCal, D., 7:1499
**Metcalfe, M.P.,** Implications of radiolytic graphite corrosion on AGR brick integrity, 7:364
**Meunier, R.,** *See* Camplan, J., 7:912
**Michel, B.,** *See* Gauthier-Lafaye, F., 7:91
**Michels, D.J.,** Solar mass ejection of 8 May 1979, 7:1348
*See* Sheeley, N.R. Jr., 7:1297
**Michoux, M.,** *See* Geffroy, J., 7:406
**Midttun, G.,** *See* Rekstad, J., 7:1595
**Mikhailov, P.A.,** *See* Mel'nikova, S.M., 7:1215
**Mikhajlov, M.Kh.,** *See* Strezov, A.S., 7:815
**Mikhajlov, P.A.,** Structural and functional change peculiarities in immunocompetent organs during radiation injury in animals treated with $\alpha_2$-macroglobulin, 7:1223
*See* Frankel', L.A., 7:1230
*See* Shantyr', V.I., 7:1211
**Mikhajlova, V.Ts.,** *See* Strezov, A.S., 7:815
**Mikoushkin, V.M.,** *See* Ogurtsov, G.N., 7:1425
**Mikula, L.,** *See* Koslik, S., 7:1111
**Mil'ko, V.I.,** Radioisotopic renography in the evaluation of rehabilitation of children operated on the occasion of hydronephrosis, 7:1105
**Milicev, M.,** *See* Jeppesen, R., 7:603
**Millard, A.,** *See* Lecarpentier, P., 7:315
**Miller, A.K.,** Stress corrosion cracking of Zircaloy. The use of laboratory data to predict in-reactor behaviour, 7:495 (IWGFPT—8, pp 239-255)
**Miller, A.R.,** *See* Curtis, L., 7:88
**Miller, J.A.,** *See* Frost, R.T.C., 7:15
**Miller, K.J.,** Mechanical behavior of materials, 7:640
**Miller, R.D.C.,** Phenomenological model for Cabibbo favoured charmed meson decays into three pseudoscalars: Psub(c) → PPP, 7:1507
**Milne, I.,** Fracture toughness and crack growth resistance of submerged arc and manual metal arc weldments in A533B plate, 7:667
**Miloslav, K.,** *See* Zdenek, K., 7:454
**Milu, C.,** *See* Tschurlovits, M., 7:933
**Minato, A.,** *See* Sako, K., 7:1699
**Mineev, Yu.V.,** *See* Vakulov, N.V., 7:1278
**Minenko, V.P.,** *See* Demirkhanov, R.A., 7:1461
**Miodownik, A.P.,** Calculation of the driving force for the radiation induced precipitation of $Ni_3Si$ in nickel-silicon alloys, 7:673
**Misfeldt, I.,** Probabilistic evaluation of fuel element performance by the combined use of a fast running simplistic and a detailed deterministic fuel performance code, 7:485 (IWGFPT—7, pp 244-251)
Use of probabilistic fuel performance codes in the planning and evaluation of irradiation experiments, 7:489 (IWGFPT—8, pp 64-70)
**Mishra, N.C.,** *See* Manjunath, C.V., 7:971
**Mitchell, A.B.,** *See* Causey, A.R., 7:389
**Mitchell, N.T.,** Environmental monitoring and deep ocean disposal of packaged radioactive waste, 7:222
**Mitrovic, R.,** *See* Begovic, J., 7:1202
**Mittal, M.L.,** Heat transfer by a developing magnetohydrodynamic flow with Hall and ion slip currents, 7:1480
**Mizon, K.J.,** *See* Gulson, B.L., 7:80
**Mizutani, T.,** Effect of pion absorption on the elastic πd scattering, 7:1569 (IPNO-TH—80-49, pp 1-7)

**Mizzan, E.,** Renovations of beta-gamma hot cells for materials studies at CRNL, 7:863
**Moesinger, H.,** *See* Schumann, U., 7:579
**Mogard, H.,** *See* Bergenlid, U., 7:491
**Mogensen, O.E.,** *See* Levay, B., 7:1435
**Mogilevskii, E.I.,** Energy of large solar and discrete structure of geoeffective solar corpuscular fluxes, 7:1283 (INIS-mf—6385, pp 151)
**Mogro-Campero, A.,** *See* Fleischer, R.L., 7:150
**Mohammadi, A.,** *See* Haque, A.K.M.M., 7:906
**Mohyla, F.,** Approaches to experimental testing of steel properties in liquid sodium, 7:651 (INIS-mf—6423, pp vp)
**Moir, R.W.,** *See* Neef, W.S. Jr., 7:1683
**Molloy, T.,** *See* Hines, G.F., 7:346
*See* Watts, A.J., 7:340
**Monfils, A.,** *See* Gardier, S., 7:949
**Moniz, E.J.,** *See* Epstein, G.N., 7:1504
**Monta, K.,** *See* Fujii, K., 7:526
*See* Kubota, J., 7:420
**Montadert, L.,** *See* Roberts, D.G., 7:51
**Montel, J.,** *See* Lambert, I., 7:816
**Montenegro, E.C.,** *See* Paschoa, A.S., 7:1190
**Moody, B.R.,** System for PIE of irradiated fuel pins, employing minimal active volume and remotely controlled transport system, 7:872
**Moore, C.B.,** *See* Natzle, W.C., 7:830
**Moore, D.A.,** *See* Ainscough, J.B., 7:484
**Moore, F.J.,** *See* Jenkinson, I.S., 7:1147
**Moore, J.G.,** Scientific basis for nuclear waste management. Volume 3, 7:188
**Moore, R.,** Yield of sister unions as a function of x-ray dose, 7:1151 (INIS-mf—6531, pp vp)
**Moore, R.L.,** Filament eruption in the 3B flare of July 29, 1973: onset and magnetic field configuration, 7:1320
**Moore, S.C.,** Magnitude and variability of disequilibrium in San Antonio Valley uranium deposit, Valencia County, 7:145
**Moore, W.E.,** *See* Lin, T.H., 7:330
**Moosecker, W.,** *See* Aschl, H., 7:738
**Morcinek, P.,** Technical and economic aspects of sodium cooled nuclear facilities, 7:396 (INIS-mf—6423, pp vp)
**Moreau, C.,** *See* Vertut, J., 7:867
**Moreno, A.,** *See* Zamorani, E., 7:187
**Morgan, P.E.D.,** *See* Harker, A.B., 7:204
**Morgand, P.,** Elastic plastic fracture toughness values for a Hastelloy alloy sample submitted to a static load, 7:689
**Morin, M.E.,** Experimental study of cancers induced in the rat by particles with high LET, 7:1193
**Morita, S.,** *See* Ishii, K., 7:1412
*See* Kamiya, M., 7:1415
*See* Sera, K., 7:1400
**Morlevat, J.P.,** *See* Kauffmann, Y., 7:703
**Morogovskii, G.B.,** *See* Antsipov, G.V., 7:1601
**Moroney, J.R.,** Radioactive fallout in the southern hemisphere from nuclear weapons tests, 7:997
**Morozova, E.I.,** *See* Val'nichek, B.I., 7:1286
**Morrison, G.H.,** Mass spectrometry, 7:763
**Morrison, I.,** Bosons and groups in nuclear physics, 7:1506
**Mortimer, N.D.,** Energy analysis applied to uranium resource estimation, 7:62
**Morton, A.C.,** *See* Knox, R.W.O'B., 7:34
**Moser, H.,** *See* Hoetzl, H., 7:1025
*See* Srdoc, D., 7:1020
**Moses, G.A.,** *See* Abdel-Khalik, S.I., 7:1685
**Moshe, M.,** High order contributions to scaling violations in QCD, 7:1536
**Mosher, D.V.,** *See* Hegge, M.R., 7:69
**Moskalenko, N.I.,** *See* Mil'ko, V.I., 7:1105
**Moskalev, V.A.,** Beam current measuring, 7:922
Determination of the position of the center of gravity of a beam, 7:924
Energy and energy spectra measuring, 7:923
**Mostovoi, V.I.,** *See* Zhudov, V.I., 7:1600
**Motohashi, S.,** *See* Muto, K., 7:378
**Mouchnino, M.,** *See* Pineira, T., 7:511
**Moulin, M.,** *See* Geffroy, J., 7:406
**Moyes, H.J.,** Automation of stable isotope analysis, 7:789
**Mrazek, L.,** *See* Kubicek, P., 7:972
**Mucha, J.,** Factors affecting qualitative and quantitative $T_3$ determination by RIA. (Experimental $T_3$ RIA kits), 7:1060 (INIS-mf—6419, pp vp)
**Mueller, B.,** *See* Kirsch, J., 7:1410
*See* Soff, G., 7:1409
**Mueller, C.,** Structure-to-structure interaction analysis for a nuclear power plant, 7:573
**Mueller, G.,** *See* Elfmann, W., 7:329
**Mueller, J.,** *See* Safarcik, K., 7:1110
**Mueller, W.,** *See* Lange, F., 7:179
**Muennich, K.O.,** *See* Sonntag, C., 7:1016
**Muir, M.D.,** *See* Crick, I.H., 7:70, 7:84
**Mukhin, I.E.,** Neoplasm appearance resulting from chronic intake of mixtures of radium-226, strontium 90, ddt, 7:1233
**Mukhopadhyay, P.,** Sequence of phase transformations in the Zr-14AT%AL alloy, 7:643
**Mukoyama, T.,** $K\beta/K\alpha$ intensity ratios and energy shifts of $K\beta$ rays produced by N-ion impact, 7:1399
**Mullan, D. J.,** Propagation of an MHD shock in the vicinity of a magnetic neutral sheet, 7:1341
**Munro, J.,** *See* Maier, G., 7:1665
**Murakami, H.,** *See* Hayakawa, S., 7:1369
*See* Watanabe, H., 7:1368
**Murakami, S.,** Creep buckling and instability of circular cylindrical shells in axial compression, 7:468
Tensor function approach to constitutive equations of inelasticity, 7:1662
**Muramoto, H.,** *See* Kaneko, H., 7:220
**Murase, H.,** Corrosion resistance of Ni and Mo coated super alloy in He-high temperature environment, 7:682
**Murr, L.E.,** Introduction to the role of crystal defects in solar materials, 7:641
Solar Materials Science, 7:260
**Murray, D.W.,** Modelling and predicting behavior of prestressed concrete secondary containment structures using BOSOR 5, 7:387
**Murthy, L.G.K.,** *See* Chaki, S.K., 7:394
**Murty, K.L.,** Prediction of creep transients in Zircaloy fuel cladding using anelastic strain model, 7:522
**Muscatello, A.C.,** *See* Horwitz, E.P., 7:745, 7:746
**Musikas, C.,** Aqueous complexes of metal ions present in the reprocessing of nuclear fuels. Complexes with the ligands orthophenanthroline and dibutyl phosphate, 7:850
**Muto, K.,** Forced vibration test of 1/5 scale model of Candu core, 7:596
Nonlinear analysis of a BWR reactor building subjected to both thermal and earthquake loadings, 7:574
Two-dimensional vibration test and its simulation analysis for a horizontal slice model of HTGR core, 7:378
**Mutterer, M.,** *See* Backe, H., 7:1411
**Myers, R.C.,** *See* Colley, M.G., 7:57

## N

**N., I.F.,** *See* Romas', R.S., 7:1116
**Nabielek, H.,** *See* Simpson, J.A., 7:351
**Nagakura, T.,** Safety analysis on transportation of radioactive materials by truck in Japan, 7:174 (INIS-mf—6447, pp vp)
**Nagase, F.,** *See* Hayakawa, S., 7:1366
**Nagato, K.,** Creep collapse of a cylindrical shell subjected to external pressure at high temperature, 7:599
**Nagle, W.J.,** Toroidal cell and battery, 7:606 (NASA-CASE-LEW—12918-1)
**Nagornyi, S.I.,** Correlation mechanism of NN pair electroproduction on nuclei, 7:1621 (KFTI—79-48, pp 45-46)
Theory of electroproduction of small relative momentum nucleon pairs on atomic nuclei, 7:1561 (KFTI—79-48, pp 47-48)
**Nagovitsina, L.I.,** *See* Mukhin, I.E., 7:1233
**Nagulin, Yu.A.,** *See* Blokh, K.O., 7:1222
**Nagy, S.,** Computerisation of the $\gamma$-spectrometric method for fission yield measurement based on GAMANAL program, 7:942 (ZfK—410, pp 126-129)
**Naidis, G.V.,** Transition to quasistationary electron energy distribution after application of electric field, 7:1467
**Naik, M.C.,** *See* Venkateswarlu, K.S., 7:278
**Nair, A.R.,** Injected gamma-tracer method for soil-moisture movement investigations in arid zones, 7:1003
**Naivar, F.,** *See* Dawson, W.K., 7:1709
**Najzer, M.,** Many channel spectrum unfolding, 7:435 (EUR—6813(Vol.2), pp 743-750)
**Nakada, Y.,** *See* Kodaira, K., 7:1370
**Nakae, N.,** *See* Kaneko, H., 7:505
**Nakagawa, Y.,** Dynamics of coronal transients: two-dimensional non-plane MHD models, 7:1361
**Nakai, Y.,** Charge transfer cross sections of $Ne^+$ and $Ne^{++}$ in rare gases, 7:1398
Charge transfer cross sections of $He^+$ and $Ne^+$ in carbon-containing molecules, 7:1417
**Nakajima, T.,** *See* Ichikawa, M., 7:483, 7:501
*See* Ito, K., 7:479
**Nakamura, H.,** Collision processes involving excited atoms, 7:1420
*See* Namiki, M., 7:1424
**Nakamura, O.,** *See* Yoshioka, K., 7:276
**Nakao, H.,** *See* Kikutake, T., 7:669
**Nakatogawa, T.,** *See* Kitade, K., 7:288

**Nakazawa, M.,** Several applications of J1 unfolding method of multiple foil data to reactor dosimetry, 7:436 (EUR—6813(Vol.2), pp 751-762)
**Namiki, M.,** Rotationally induced transitions in atomic collisions, 7:1424
**Namisnyk, M.,** Energy sources: Australia's needs. Proceedings of the Australian Institute of Energy first National Conference, held in Newcastle on February 5-9, 1979, 7:998
**Nandanpawar, M.,** Radiation damage in some EN steels, 7:700
**Narasimhan, S.V.,** *See* Venkateswarlu, K.S., 7:278
**Narayan, K.,** In vivo study of effects of ionizing radiation in rabbit ear chambers, 7:1160 (INIS-mf—6531, pp vp)
*See* Cliff, W.J., 7:1161
**Narayanan, P.S.A.,** *See* Balakrishna, P., 7:287
**Narita, M.,** Few applications of solid state track detector to reactor physics experiments, 7:937 (KURRI-TR—190, pp 16-20)
**Narita, O.,** Atmospheric dispersion study with $^{85}Kr$ and $SF_6$ gas, 7:993
**Narlikar, A.V.,** *See* Bhide, V.G., 7:1660
**Narumi, H.,** Λ-nucleon potential and binding energy of the hypertriton, 7:1625 (TRI—79-1, pp 117-120)
**Nasby, R.D.,** *See* Garner, C.M., 7:250
**Nashiro, T.,** *See* Kosinski, W., 7:1664
**Nataf, R.,** Constraints on nucleon quark models from deep inelastic scattering data, 7:1552 (IPNO-TH—80-49, pp 1-31)
**Natarov, V.V.,** Iodine accumulating activity of thyroid autoplastic graft in the early period after subtotal resection of thyroid, 7:1107
**Nath, D.,** *See* Ganguli, S., 7:1650
**Nathrath, N.,** Plasma centrifuge III: Measurements on rotating uranium plasmas, 7:162
*See* McClure, J.J., 7:161
**Natzle, W.C.,** Dissociative ionization of water induced by single-photon vibrational excitation, 7:830
**Naudet, R.,** *See* Gauthier-Lafaye, F., 7:91
**Naumova, G.M.,** Effect of complex preparations on C and P vitamins on the chromosomal aberration formation in hepatocytes of the irradiated rats, 7:1227
**Navada, S.V.,** *See* Nair, A.R., 7:1003
**Navratil, J.D.,** *See* Fuger, J., 7:847
**Navrestad, T.,** *See* Jorgensen, F., 7:46
**Nazarova, M.N.,** *See* Pereyaslova, N.K., 7:1384
**Nechvatal, J.,** *See* Havel, S., 7:312
**Neda, T.,** *See* Fujii, K., 7:526
**Needham, R.S.,** Geology of the Alligator Rivers Uranium Field, 7:68
Overview of metallic mineralization in the Pine Creek Geosyncline, 7:1257
Regional geology of the Pine Creek Geosyncline, 7:1250
*See* Crick, I.H., 7:70
*See* Page, R.W., 7:1252
*See* Stuart-Smith, P.G., 7:1251
**Needleman, A.,** *See* Tvergaard, V., 7:462
**Neef, W.S. Jr.,** Mirror fusion reactor design, 7:1683
**Neimark, L.A.,** Post-irradiation examination of light water reactor fuel. A United States perspective, 7:510
**Neitzel, H.J.,** *See* Rosinger, H.E., 7:550
**Nelson, G.J.,** *See* Duncan, R.A., 7:1347
**Nelson, R.A.,** RELAP4/MOD6 reflood heat transfer and data comparison, 7:558
**Nemashkalo, B.A.,** *See* Shebeko, K.V., 7:1587
**Nemet, J.,** HTR applications of the Austrian PCPV, 7:337 (IWGHTR—2, pp 58-63)
**Nereson, N.G.,** *See* McDowell, R.S., 7:829
**Nesbitt, H.W.,** Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
**Nesvadba, M.,** Use of nuclear heat for a food and agricultural complex. Conclusions of model solution for reference locality of WWER type power plants in Czechoslovakia, 7:1134 (INIS-mf—6420, pp vp)
**Neumann, L.,** *See* Hermsdorf, D., 7:1585
**Newbigging, A.W.P.,** Contribution of post-irradiation examination to the development of AGR fuel, 7:343
**Newman, J.,** *See* Pollard, R., 7:609, 7:610
*See* Trainham, J.A., 7:635
**Ng, D.H.Y.,** Yielding of 6061-T6 aluminium tubings under dynamic biaxial loadings, 7:697
**Nguyen, V.U.,** Design of a large field shear box, 7:10
**Nguyen Dang, H.,** Sheakedown analysis by displacement method and equilibrium finite element, 7:1666
**Nicholson, D.R.,** *See* Hoyng, P., 7:1336
**Nicholson, P.J.,** Requirements and concepts for a nuclear plant surveillance and diagnostic system (NPSDS), 7:523 (AECL—7056, pp 9-19)
**Nicholson, P.M.,** Geology and economic significance of the Golden Dyke Dome, Northern Territory, 7:1260
**Nicolaysen, L.O.,** *See* Hart, R.J., 7:1274
**Nicolescu, B.,** Attempt to derive the hadron mass spectrum from the topological expansion, 7:1526 (IPNO-TH—80-49, pp 1-4)
**Nicovich, J.M.,** Kinetics of the reactions of the hydroxyl radical with xylenes, 7:831
**Niczyporuk, B.,** *See* Bienlein, J.K., 7:1496
**Nieder, R.,** Role of adsorption processes in gas graphite reactions in high temperature gas-cooled reactors, 7:360
**Nielsen, B.L.,** Uranium potential of Greenland - A geological analysis of favourability, 7:129
**Nieminen, R.M.,** Density-functional theory of positronium bubbles in low-temperature classical fluids, 7:1434
**Nihoul, J.,** *See* Mathieu, F., 7:929
**Nikjoo, H.,** *See* Haque, A.K.M.M., 7:906
**Nimal, J.C.,** *See* Alberman, A., 7:289
**Nipko, S.E.,** *See* Samuleva, S.V., 7:1210
**Nishikawa, H.,** *See* Kitade, K., 7:288
**Nishikawa, M.,** Released rare gas and its hold-up in nuclear power plant, 7:280 (KURRI-TR—179, pp 28-31)
**Nishimura, H.,** SIMS measurements of magnesium isotopic abundance ratio in the Allende carbonaceous chondrite, 7:1289
**Nistor, O.,** General report on radioecological studies and radioactivity monitoring measurements of the Danube River, 7:1044 (IAEA-TECDOC—229, pp 149-152)
**Nizovsky, V.I.,** *See* Bronin, S.Ya., 7:1462
**Noci, G.,** Model of surge, 7:1338
**Noda, T.,** Thermodynamic analyses of impure helium for HTGR material testing, 7:820
**Noguchi, K.,** *See* Hayakawa, S., 7:1369
**Nolthenius, H.J.,** *See* Zijp, W.L., 7:438
**Nomura, S.,** *See* Sasaki, Y., 7:731
**Norfolk, D.J.,** Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839
**Norgett, M.J.,** Defect modelling, 7:647 (AERE-TP—843, pp 191-206)
**Norwood, K.S.,** *See* Bennett, M.J., 7:358
**Nova, R.,** *See* Hueckel, T., 7:1269
**Novak, J.,** Practical application of hepatitis B antigen and antibody determination by RIA in transfusion services, 7:1064 (INIS-mf—6419, pp vp)
*See* Kselikova, M., 7:1065
**Novotny, J.,** *See* Horsky, J., 7:1661
**Nuernberg, H.W.,** *See* Schladot, J.D., 7:1
**Nuno, H.,** Treatment of numerical problems due to rapid creep rate in the fuel performance calculation by FEM, 7:472 (IWGFPT—7, pp 56-66)
**Nuttall, H.E.,** Combined fracture/porous media model for contaminant transport of radioactive ions, 7:227
**Nyary, I.,** *See* Matus, L., 7:768
**Nydal, R.,** How accurate is the $^{14}C$ method, 7:1263
**Nyholm, R.,** ESCA investigation of molybdenum containing silicate and phosphate glasses, 7:200
**Nyilas, A,** *See* Krauth, H., 7:674
**Nyman, G.,** *See* Peuser, P., 7:1590

## O

**O'Brien, D.W.,** LLNL nuclear chemistry automated production counting facilities: design and implementation, 7:1708
**O'Connor, M.,** *See* Cords, H., 7:737
**O'Donnell, W.J.,** Creep tensile instability, 7:455
*See* Porowski, J.S., 7:695
**O'Hare, P.A.G.,** Summary of the symposium, 7:167
*See* Flotow, H.E., 7:813
**O'Keefe, J.M.,** Detection and location of leaks in irradiated CAGR fuel, 7:350
**Oakes, D.B.,** Solute transport in the unsaturated zone of the Chalk, 7:1034
**Obelic, B.,** *See* Srdoc, D., 7:1020
**Ochiai, Y.,** *See* Kudo, H., 7:1429
**Ochs, W.,** Angular flow of charge and energy in hadron hadron collisions, 7:1511
*See* Krawczyk, M., 7:1522
**Ocken, H.,** *See* Miller, A.K., 7:495
*See* Neimark, L.A., 7:510
**Oda, N.,** *See* Sataka, M., 7:1405
**Odette, G.R.,** Approaches to assessing the failure resistance of fusion reactor first walls, 7:1696
*See* Stahlkopf, K.E., 7:456
**Odinov, B.V.,** *See* Zhudov, V.I., 7:1599, 7:1600

**Oele, J.A.**, Rotliegend gas fields of the K and L blocks, Netherlands Offshore (1968 to 1978): a case history, 7:54
**Oganesyan, Yu.T.**, Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385, pp 261-276)
**Ogata, Y.**, Development of the equipment for fission gas collection by laser puncturing, 7:412
**Ogawa, K.**, *See* Narumi, H., 7:1625
**Ogawa, S.**, *See* Nuno, H., 7:472
**Ogawara, Y.**, Observation of soft x-ray and hard x-ray by the satellite Hakucho, 7:1371
**Ogiwara, Y.**, *See* Takemori, T., 7:588
**Ogonowska, U.**, Temperature dependant decay of metastable state of systems with large impurity-lattice relaxation ($CdF_2$:In), 7:726
**Ogurtsov, G.N.**, Autoionization in multiply-charged ion-atom collisions, 7:1425
**Ogurtsov, V.I.**, *See* Dementii, S.V., 7:1565
**Ohashi, N.**, Fracture toughness of heavy section LWR pressure vessel steel plate produced by basic oxygen furnace and ladle refining process, 7:668
**Ohori, T.**, *See* Kitagawa, M., 7:1418
**Ohtani, N.**, Application of cross section sensitivity analysis to 'JOYO' main shield, 7:416
**Ohtani, S.**, *See* Kaneko, Y., 7:1414
**Ohtsuki, Y.H.**, *See* Kitagawa, M., 7:1418
**Ohuchi, A.**, Analytical procedures using instruments in the post-irradiation examination of fuels, 7:285
Computer controlled nondestructive testing on the irradiated fuel rod, 7:283
**Ojanen, M.**, *See* Seppae, E.K., 7:554
**Okada, M.**, *See* Hirano, T., 7:684
*See* Noda, T., 7:820
**Okada, S.**, Doppler broadened annihilation radiation study in various liquid mixtures, 7:1436
**Okamoto, K.**, *See* Kikutake, T., 7:669
**Okano, H.**, *See* Fujii, K, 7:530
**Okano, J.**, *See* Nishimura, H., 7:1289
**Okhlopkov, V.P.**, Long-period variations of cosmic rays in the stratosphere, 7:1382 (INIS-mf—6290, pp 56-57)
**Okrent, D.**, Fusion reactor safety, 7:1686
**Okubo, T.**, *See* Ichikawa, M., 7:483, 7:501
*See* Ito, K., 7:479
**Okuda, T.**, *See* Yamada, J., 7:1478
**Okudaira, K.**, *See* Watanabe, H., 7:1368
**Okulov, Yu.I.**, Electromagnetic properties of a cosmic ray gas and diamagnetism of solar cosmic rays in magnetic traps, 7:1280 (INIS-mf—6385, pp 122-123)
**Okuno, K.**, *See* Kaneko, Y., 7:1414
*See* Sataka, M., 7:1405
**Olbert, S.**, *See* Heinemann, M., 7:1307
**Oldfield, W.**, *See* Wullaert, R.A., 7:292
**Oliva, I.**, Diagnostic and therapeutic value of angiography in gastro-intestinal surgical stump haemorrhages, 7:1090
**Olive, P.**, *See* Allemmoz, M., 7:1022
**Olmstead, R.**, *See* McNeil, T., 7:532
**Olsson, S.**, Operation with monosequences in ASEA-ATOM BWR. A way of reducing the impact of PCI, 7:279 (IWGFPT—8, pp 71-78)
**Onaka, T.**, *See* Kodaira, K., 7:1370
**Ono, S.**, *See* Tsukada, H., 7:666
**Onozuka, N.**, *See* Iida, K., 7:670
**Ooi, H.**, *See* Ohashi, N., 7:668
**Ootuka, A.**, *See* Kawatsura, K., 7:1403
**Opat, G.I.**, Oscillations of massless neutrinos as a refractive phenomenon, 7:1509
**Opauszky, I.**, *See* Matus, L., 7:768
**Opitz, M.**, Dynamic surface composition changes in Ag-Pd alloys under ion bombardment at different ion energies, 7:657
**Orth, K.**, Standardization and the atomic energy law, 7:429
**Ortiz, N.V.**, *See* Ethridge, F.G., 7:105
**Ortman, M.S.**, *See* Abdel-Khalik, S.I., 7:1685
**Osborne, R.V.**, Personal tritium monitor, 7:383
**Ostapenko, V.A.**, *See* Kurochka, L.N., 7:1285
**Oszuszky, F.**, Nuclear energy controversy in Austria. A sociological problem, 7:616
**Ott, W.F.**, *See* Bodenhausen, J.W.A., 7:36
**Otter, N.R.**, Life prediction of simple structures subject to cyclic primary and secondary loading resulting in creep and platicity, 7:379
**Otto, H.**, *See* Peuser, P., 7:1590
**Otwinowski, Z.**, Relativistic potential model of charmonium, 7:1544
**Outlaw, B.D.**, *See* Challinor, A., 7:20
**Oversby, V.M.**, *See* Ringwood, A.E., 7:728
**Owens, B.**, Palynology, its biostratigraphic and environmental potential, 7:1249
**Oxburgh, E.R.**, Temperature, thermal gradients and heat flow in the southwestern North Sea, 7:23
**Oxley, E.**, Investigation of nuclear grade graphite for possible sea-water contamination using a thermal oxidation technique, 7:724
**Oza, A.K.T.**, *See* Bandyopadhyay, A.K., 7:1654
**Ozawa, K.**, *See* Kawatsura, K., 7:1403
*See* Nakai, Y., 7:1398, 7:1417

## P

**Packwood, A.**, *See* Hall, M.C.G., 7:308
**Page, R.W.**, Geochronology and evolution of the late-Archaean basement and Proterozoic rocks in the Alligator Rivers Uranium Field, Northern Territory, Australia, 7:1252
**Pagel, M.**, Contribution to some Saskatchewan uranium deposits mainly from fluid inclusion and isotopic data, 7:90
**Paily, P.P.**, Mixing zone analysis for river plumes, 7:281
**Paisey, M.J.**, *See* Hitchcock, P.A., 7:354
**Paisey, M.S.**, *See* Haddrell, V.J., 7:882, 7:884
**Pakhomov, P.I.**, KCl crystal for dosimetry of hard X-ray and gamma radiation, 7:968
**Palgen, L.**, *See* Nguyen Dang, H., 7:1666
**Pallagi, D.**, *See* Selivanov, V.M., 7:453
**Palmer, J.E.M.**, *See* Pritchard, J.A., 7:841
**Palmer, R.A.**, *See* Schulz, W.W., 7:199
**Palmiotti, G.**, *See* Estiot, J.C., 7:451
**Palusamy, S.S.**, Elastic-plastic response of PWR coolant pipes containing postulated circumferential flaws, 7:326
**Panigrahi, N.**, *See* Sen, P., 7:777
**Pankaskie, P.J.**, Mechanistic considerations pertinent to the PCI fuel failure phenomenon, 7:504 (IWGFPT—8, pp 255-287)
**Pannetier, R.**, *See* Philippot, J.C., 7:770
**Panov, A.S.**, *See* Zagryazkin, V.N., 7:852
**Panter, H.C.**, Cell killing as a function of position of tritiated uridine in the cell, 7:1169 (INIS-mf—6531, pp vp)
**Papp, R.**, *See* Patrashakorn, S., 7:431
**Paris, R.**, *See* Clark, P.A., 7:878
**Parisi, M.**, *See* Iucci, N., 7:1350
**Park, R.M.**, Low-energy ion source for p-type doping in MBE, 7:729
**Parker, F.L.**, Management of radioactive wastes in the United States of America, 7:221
**Parmeggiani, A.**, *See* Chevallard, G., 7:390
**Parr, R.M.**, Biomedical sciences, Chapter 5, Section 1, 7:755
**Parry, C.C.**, Integration of palynological and sedimentological methods in facies analysis of the Brent Formation, 7:29
**Parshutin, V.V.**, Corrosion behaviour of Ni-Re, Ni-Re-Mo, Ni-Re-Hf, Ni-Re-W-Hf alloys, 7:686
**Parsons, J.A.**, *See* Tam, C.S., 7:1077
**Paryzek, R.**, System and equipment for securing operation safety of experimental stand, 7:548 (INIS-mf—6423, pp vp)
**Parzyck, D.C.**, Comparative health risks of energy production, 7:1052
**Paschis, J.A.**, *See* Voto, R.H. de, 7:93
**Paschoa, A.S.**, RA-226 collective dosimetry for surface waters in the uranium mining region of Pocos de Caldas, 7:1190
*See* Cullen, T.L., 7:1189
**Pasek, J.**, Practical experience with KR-1010 radiometer in ZUD coal mines at Zbuch, 7:3 (INIS-mf—6422, pp vp)
**Pashchenko, N.S.**, *See* Yasinova, A.A., 7:1220
**Pashenko, N.S.**, Formation of autohemolysins in radiotherapy of oncologic patients, 7:1239
**Pasi, M.**, Portable nuclear level gauge using a neutron source, 7:931 (IA—1356, pp 303-304)
*See* Keren, M., 7:932
**Pasotti, G.**, *See* Matera, R., 7:1681
**Passariello, R.**, *See* Simonetti, G., 7:1092
**Pasztor, E.**, Pressure dependence and stability of the extracted ion current in arc-discharge-type heavy-ion sources, 7:1396
*See* Matus, L., 7:768
**Patek, P.R.M.**, Absorption of dose rate in great bitumen blocks. Experimental detection, 7:240
**Pati, S.R.**, Fission gas release during anticipated PWR transients, 7:553 (IWGFPT—7, pp 160-167)
**Patrashakorn, S.**, Recycling of actinides in light water reactors, 7:431
**Patriarca, R.**, *See* Ubertini, P., 7:948
**Patterson, J.A.**, Long term uranium supply outlook, 7:184
**Pauko, M.**, *See* Najzer, M., 7:435
**Paul, A.R.**, *See* Venkateswarlu, K.S., 7:278
**Paul, W.**, Properties of amorphous hyrogenated silicon, with special

emphasis on preparation by sputtering. 7:251
**Pauwels, C.,** *See* Leridon, A., 7:585
**Pauwels, E.K.J.,** *See* van Voorthuisen, A.E., 7:1177
**Pavlova, T.D.,** Hemodynamic changes in patients with cervix uteri carcinoma in the process of combined radiotherapy according to the data of arterial oscillography. 7:1218
**Pavlova, T.S.,** *See* Davydova, L.I., 7:1104
**Pavlovskij, O.A.,** *See* Gusev, D.I., 7:1039
**Payne, B.R.,** Study of the leakage between two aquifers in Hermosillo, Mexico, using environmental isotopes. 7:1018
**Pchelin, V.A.,** *See* Zelenkov, A.G., 7:1598
**Peagram, G.W.,** Remote handling and viewing for the future. 7:870
**Pechstein, H.,** *See* Henkel, R., 7:947
**Pedersen, C.P.,** Experience with the track etch method for uranium exploration in Northern Australia. 7:131
**Pederson, L.R.,** *See* McVay, G.L., 7:716
**Pedrosa, C.S.,** *See* Casanova, R., 7:1096
*See* Santos, J.M., 7:1093
**Peehs, M.,** Experiments to settle an ISCC hypothesis for Zry-tubing. 7:503 (IWGFPT—8, pp 170-181)
Interaction of molten 'corium' with concrete in a hypothetical LWR core-melt-down accident. Oxidation of core materials and hydrogen production. 7:562
**Peery, R.J.,** Low-level radioactive waste management: an economic assessment. 7:185 (NP—2900892)
Low-level radioactive waste management: a regional compact. 7:242 (NP—2900891)
**Pehl, R.H.,** *See* Strauss, M.G., 7:1001
**Peinturier, P.,** *See* Guesnier, G., 7:524
**Peisach, M.,** Prompt techniques. Chapter 3. Section 6. 7:753
Specific counting techniques. Chapter 3. Section 5. 7:752
**Peleganchuk, Yu.I.,** *See* Shamov, A.I., 7:769
**Pellantova, Z.,** *See* Huskova, M., 7:1055
**Pellisier-Tanon, A.,** *See* Devaux, J.C., 7:691
**Pensko, J.,** Assessment of biological effects resulting from large scale applications of coal power plant wastes in building technology in Poland. 7:1196
**Pensom, C.F.,** *See* Shah, R.R., 7:536
**Peray, R.,** *See* Clottes, G., 7:409
**Peresun'ko, Yu.P.,** *See* Boldyshev, V.F., 7:1500
**Pereyaslova, N.K.,** Change of a time profile in solar cosmic ray events during magnetic storms. 7:1384 (INIS-mf—6290, pp 74-75)
**Perlman, I.,** Analysis of gamma-ray spectra. Chapter 3. Section 1. 7:748
Applications to archaeology. Chapter 5. Section 5. 7:759
**Perrin, J.,** Prediction of dynamic stability limits of the 45MW scale model of SUPER PHENIX steam generator. 7:421
**Perrot, M.,** *See* Cytermann, R., 7:413
**Persson, B.R.,** *See* Holm, E., 7:1048
**Pescatore, C.,** *See* Machiels, A.J., 7:214
**Petelski, E.F.,** Model calculations of solar wind expansion including an enhanced fraction of ionizing electrons. 7:1312
**Peterson, H.T.,** *See* Battist, L., 7:1187
**Peterson, R.J.,** Geology of pre-Dakota uranium geochemical cell, sec. 13, T. 16 N., R. 17 W., Church Rock area, McKinley County. 7:108
*See* Smith, D.A., 7:116
**Petersson, B.,** *See* Baier, R., 7:1542
**Petitgrand, S.,** Predictions of the thermomechanical code RESTA compared with fuel element examinations after irradiation in the BR3 reactor. 7:301 (IWGFPT—7, pp 210-216)
**Petrenko, I.E.,** *See* Pereyaslova, N.K., 7:1384
**Petrusenko, Yu.T.,** Device for the low-temperature electron irradiation. 7:247 (KFTI—79-65, pp 83-85)
**Pettigrew, M.J.,** *See* Ko, P.L., 7:442
**Pettit, R.B.,** Solar mirror materials: their properties and uses in solar concentrating collectors. 7:263
*See* Roth, E.P., 7:264
**Petz, G.,** *See* Opitz, M., 7:657
**Peuser, P.,** Decay properties of neutron-rich isotopes of Rb ($Z = 37$) to Tc ($Z = 43$) and the mass-energy surface around $A = 100$. Chapter 5. 7:1590
**Pezlar, O.,** *See* Zaduban, M., 7:1135
**Pfiffelmann, J.P.,** *See* Gauthier-Lafaye, F., 7:91
**Pham, H.Q.,** *See* Jaffe, L.D., 7:258
**Phelps, M.E.,** *See* Hoffman, E.J., 7:1118
**Philip, G.M.,** Australia's mineral energy resources: assessment and potential. Proceedings of a seminar held in Sydney, 1978. 7:124
**Philippot, J.C.,** Analysis of uranium isotopic abundances by fine gamma spectrometry. 7:770
Real time operation of a multiple gamma measurement installation. 7:946
**Phillips, B.F.,** Application of multiple technique surface analysis to the study of preferential sputtering and other surface phenomena. 7:1428
**Phillips, J.,** *See* Goodman, A.M., 7:467
**Picat, J.P.,** *See* Crifo, F., 7:1295
**Picha, J.,** *See* Hampl, A., 7:1062
**Pichlmayer, F.,** *See* Irleweck, K., 7:767
**Pichova, D.,** *See* Veres, K., 7:1056
**Pickens, J.F.,** Field determination of the physical contaminant transport parameters in a sandy aquifer. 7:1045
**Pickles, E.,** *See* Harms, J.C., 7:42
**Pieper, K.,** *See* Baro, G., 7:307
**Piesch, E.,** *See* Massera, G.E., 7:957
**Pietsch, H.B.,** *See* Kaempf, F., 7:159
**Pietz, M.R.,** In cell machines for the inspection of fast reactor fuel elements. 7:888
**Pillay, K.K.S.,** *See* Vance, E.R., 7:718
**Piller, R.C.,** *See* Marwick, A.D., 7:920
**Pillinger, C.T.,** *See* Fallick, A.E., 7:764
**Pinchuk, V.P.,** *See* Mil'ko, V.I., 7:1105
**Pineira, T.,** Review and comments about gamma scanning analysis on PWR and FBR fuel elements. 7:511
*See* Atabek, R., 7:305
**Pisani, U.,** *See* Lanza, S., 7:565
**Pisarenko, N.F.,** *See* Val'nichek, B.I., 7:1286
**Pisco, J.M.,** *See* Lang, E.K., 7:1176
**Piskareva, E.V.,** Some changes in ultrastructure of bone marrow cells in its aplastic states. 7:1212
*See* Mamotyuk, E.M., 7:1208, 7:1225
*See* Markov, V.I., 7:1229
**Pitak, O.,** Continuous analyzers of hydrogen and carbon in liquid sodium and of hydrocarbon total in protective atmosphere above sodium. 7:405 (INIS-mf—6423, pp vp)
**Pitzer, K.S.,** *See* Rogers, P.S.Z., 7:812
**Place, J.,** Mineralogy and geochemistry of Mariano Lake uranium deposit, Smith Lake district. 7:113
**Plafkin, J.L.,** *See* Cairns, J. Jr., 7:1114
**Pnazeca, T.,** *See* Polizzotto, C., 7:1667
**Pneuman, G.W.,** Reconnection driven coronal transients. 7:1340
**Podorozhanskaya, N.M.,** *See* Koshkin, V.M., 7:1651
**Pohl, R.O.,** *See* Skvarla, M.F., 7:197
**Pointud, M.L.,** *See* Bruet, M., 7:302
**Pokh-Drobantsev, V.V.,** *See* Lutsenko, S.M., 7:1115
**Pokorski, S.,** *See* Furmanski, W., 7:1547
**Pokrovskaya-Soboleva, A.S.,** Dependence of breakdown voltage on adsorbed gases. 7:1450
*See* Shapiro, A.L., 7:1451
**Polcaro, V.F.,** *See* Ubertini, P., 7:948
**Poletto, G.,** UV emitting spicules. 7:1318
**Polizzotto, C.,** Local bounds on dissipation energy in shakedown theory. 7:1667
**Pollard, R.,** Mathematical modeling of the lithium-aluminum, iron sulfide battery. 1. Galvanostatic discharge behavior. 7:609
Mathematical modeling of the lithium-aluminum, iron sulfide battery. 2. The influence of relaxation time on the charging characteristics. 7:610
**Pollock, R.E.,** *See* Harms, J.C., 7:42
**Polunin, Yu.P.,** *See* Elaev, V.F., 7:894
**Polyakov, E.G.,** *See* Polyakova, L.P., 7:824
**Polyakov, Ye.A.,** *See* Duvidzon, V.M., 7:1458
**Polyakova, L.P.,** Electrochemical properties of potassium heptafluoroniobate in chloride-fluoride melts. 7:824
**Pomathiod, L.,** Properties and discharge mechanisms of a saddle-field ion source. 7:1391
**Ponsot, J.,** *See* Bosser, M., 7:314
**Popova, T.Ya.,** *See* Kurbatov, A.A., 7:1479
**Popowicz, Z.,** Baecklund transformation, local and nonlocal conservation laws for super-chiral fields. 7:1532
**Porkolab, M.,** *See* Schuss, J.J., 7:1675
**Porodzinskii, Yu.V.,** *See* Antsipov, G.V., 7:1601
*See* Zenevich, V.A., 7:1602
**Porowski, J.S.,** Creep ratcheting bounds based on elastic core concept. 7:695
*See* O'Donnell, W.J., 7:455
**Porsche, H.,** Proposal for an interplanetary mission to sound the outer regions of the solar corona. 7:1365
**Porstendoerfer, J.,** *See* Kiefer, J., 7:1049
**Portal, M.,** *See* Geffroy, J., 7:406
**Porter, D.A.,** *See* Wentworth, D.W., 7:109
**Posfai, J.,** *See* Keszthelyi, L., 7:844
**Pospisil, P.,** Relations between surface and ground water studied by tritium analyses. 7:1033 (INIS-mf—6422, pp vp)
**Possa, G.,** *See* Chevallard, G., 7:390
**Poster, R.,** *See* Wise, J., 7:1487
**Pots, B.F.M.,** *See* van der Sijde, B., 7:899

**Potter, J.,** *See* Dawson, W.K., 7:1709
**Potter, P.E.,** Advanced fuels for fast breeder reactors. A critical assessment of some phase equilibria, 7:706
**Potts, J.T. Jr.,** *See* Holick, M.F., 7:1173
**Potts, R.,** *See* Matera, R., 7:1681
**Poty, B.,** *See* Pagel, M., 7:90
**Pouchan, P.,** *See* Fontes, J.C., 7:1026
**Powar, M.S.,** *See* Ahmad, S., 7:1643
**Powers, D.A.,** Influence of gas generation on melt/concrete interactions, 7:561
**Prabhu, L.H.,** *See* Vartak, D.G., 7:784
**Pradhan, D.G.,** *See* Singh, R.R., 7:245
**Predazzi, E.,** Naive model of hadrons and hadronic processes, 7:1516
**Preobrazhensky, N.G.,** *See* Kurbatov, A.A., 7:1479
**Preston, A.,** *See* Mitchell, N.T., 7:222
**Prestwood, J.,** *See* Banks, D.A., 7:284
**Preto, S.K.,** *See* Tomczuk, Z., 7:608
**Prewett, P.D.,** Liquid metal field-emission ion sources and their applications, 7:1392
**Pribysova, J.,** *See* Cerman, J., 7:1059
*See* Suba, P., 7:1058
**Price, D.J.,** *See* Hitchcock, P.A., 7:354
**Price, L.R.,** *See* Smith, D.W., 7:1486
**Prince, A.,** Phenomenological optical potentials and optical model computer codes, 7:1607 (IAEA-SMR—43, pp 149-164)
**Pringle, S.T.,** *See* Collier, D., 7:533
**Prior, H.A.,** *See* Bennett, M.J., 7:358
*See* Faircloth, R.L., 7:361
**Prishepin, L.V.,** *See* Mukhin, I.E., 7:1233
**Pritchard, J.A.,** Radiolytic oxidation of methane in commercial advanced gas cooled reactors, 7:841
Sulphur ingress into Hinkley Point 'B' AGR and its effect on carbon monoxide oxidation, 7:368
**Prnka, T.,** *See* Morcinek, P., 7:396
**Prokhorets, I.M.,** *See* Arkatov, Yu.M., 7:1564
**Prokopiev, V.E.,** *See* Bokhan, P.A., 7:895
**Proskurivsky, D.I.,** *See* Litvinov, E.A., 7:1445
**Prost, J.P.,** Experimental and elastic-plastic numerical analysis of a PWR piping elbow subjected to pressure cycling, 7:322
**Prostiakov, V.V.,** *See* Selivanov, V.M., 7:453
**Prosvirov, V.P.,** *See* Granovskaya, N.N., 7:1102
**Prothero, D.H.,** *See* Matera, R., 7:1681
**Puiseux-Dao, S.,** *See* Bonotto, S., 7:1192
**Pusch, R.,** Highly compacted bentonite: a self-healing substance for nuclear waste isolation, 7:219
**Putz, Z.,** *See* Veleminsky, J., 7:1067

## Q

**Quay, P.D.,** Whole lake tritium spikes to measure horizontal and vertical mixing rates, 7:1028
**Quijano, L.,** *See* Payne, B.R., 7:1018
**Quintanar, R.J.,** *See* Foster, J.F., 7:142

## R

**Rabbe, P.,** *See* Devaux, J.C., 7:691
**Rabin, M.S.Z.,** *See* Wise, J., 7:1487
**Rabinovici, E.,** *See* Haber, H.E., 7:1533
**Racinoux, J.,** *See* Musikas, C., 7:850
**Radak, L.J.,** *See* Mansour, M.N., 7:845
**Radde, I.C.,** *See* McKercher, H.G., 7:1079
**Rado, V.,** *See* Carta, M., 7:544
**Radon, J.C.,** Fracture and fatigue, elasto-plasticity, thin sheet and micromechanisms problems, 7:677
**Raeder, J.,** *See* Daenner, W., 7:1695
**Raes, F.,** *See* Eggermont, G., 7:992
**Ragheb, M.M.,** *See* Abdel-Khalik, S.I., 7:1685
**Raics, P.,** *See* Nagy, S., 7:942
**Raitio, R.,** Jet production in $e^+e^-$ collisions to order $\alpha^3$ and $\alpha^4$ and including QCD, 7:1523
**Raj, B.,** *See* Rao, C.B., 7:520
**Rajagopalan, P.P.,** Effect of precompaction on sintered $UO_2$ pellets, 7:519
**Rajagopalan, S.,** *See* Nandanpawar, M., 7:700
**Rajput, A.K.,** Evaluation of design pressure for the F.B.T.R. secondary sodium heat transfer system and its components in case of a leak in steam generator, 7:605
**Ram, P.N.,** *See* Tiwari, M.D., 7:688
**Ramachandran, R.,** Factors affecting the sintered density of plutonium oxide, 7:521
*See* Rajagopalan, P.P., 7:519
**Ramaekers, P.,** *See* Hoeve, J., 7:87
**Ramakrishna, J.,** *See* Rukmani, K., 7:970
**Ramamurthy, V.S.,** Theories and approximations of nuclear level densities, 7:1608 (IAEA-SMR—43, pp 187-203)
**Ramasami, K.,** *See* Cartz, L., 7:719
**Ramkova, N.V.,** Comparative assessment of methods of determination of initial sowing and contaminant radiosensitivity, 7:1137 (INIS-mf—5673, pp 23-24)
**Ramm, E.,** *See* Saettele, J.M., 7:319
**Ramm, E.J.,** *See* Reeve, K.D., 7:708
**Ramsay, R.,** *See* Chen, P., 7:1149
**Ramsay, W.V.,** *See* Burnhill, T.J., 7:32
**Ramsden, A.R.,** *See* Binns, R.A., 7:79
**Ramsey, R.,** *See* Westerman, M., 7:1150
**Ranft, J.,** Gluon jet effects in deep inelastic lepton-hadron collisions, 7:1537
**Rao, C.B.,** Steady state behaviour of gaseous fission products in $UO_2$ nuclear fuel at low temperature, 7:520
**Rao, M.S.,** *See* Sen, P., 7:777
**Rao, S.M.,** *See* Nair, A.R., 7:1003
**Rapolti, I.,** *See* Nagy, S., 7:942
**Rappaz, M.,** *See* Floran, R.J., 7:720
**Ratier, J.L.,** *See* Clottes, G., 7:409
**Ratnam, B.A.,** *See* Dharmadurai, G., 7:1656, 7:1657
**Rauert, W.,** *See* Hoetzl, H., 7:1025
**Rautenberg, J.,** Design of heat exchangers for high-temperature reactors, 7:377
**Rautman, C.A.,** Geology and mineral technology of the grants uranium region 1979, 7:59 (CONF-7905120—)
**Raval, M.N.,** *See* Vartak, D.G., 7:782
**Raven, L.F.,** *See* Howl, D.A., 7:303
**Ravinger, R.,** Radiotracer monitoring of water flow in dams, 7:1032 (INIS-mf—6422, pp vp)
**Ravishankara, A.R.,** *See* Nicovich, J.M., 7:831
**Rawls, J.M.,** *See* Shannon, T.E., 7:1682
**Rawson, R.R.,** Uranium in Todilto Limestone (Jurassic) of New Mexico: example of a Sabkha-Like Deposit, 7:147
**Ray, A.K.,** *See* Nuttall, H.E., 7:227
**Ray, I.L.F.,** *See* Blank, H., 7:473
**Ray Chaudhury, M.,** Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V, 7:1658
**Raychaudhuri, K.,** *See* Wise, J., 7:1487
**Razgulyaeva, V.I.,** *See* Pokrovskaya-Soboleva, A.S., 7:1450
*See* Shapiro, A.L., 7:1451
**Rebora, B.,** *See* Rodriguez, C., 7:334
**Reboul, J.C.,** *See* Gauthier-Lafaye, F., 7:91
**Redeker, K.,** Acknowledged rules of technology as a legal term in public law, 7:1711
**Redlich, L.,** Ion acoustic waves in noble gas ion lasers, 7:901
**Reekie, J.,** *See* Barrett, T.R., 7:866
**Reeve, K.D.,** SYNROC research and development at Lucas Heights, 7:708
*See* Ringwood, A.E., 7:205
**Reffo, G.,** Parameter systematics for statistical theory calculations of neutron reaction cross-sections, 7:1609 (IAEA-SMR—43, pp 205-230)
**Reginato, R.,** Remote assessment of soil moisture, 7:1124 (IAEA-TECDOC—236, pp 75-85)
**Reid, J.B.,** *See* Bruno, J., 7:528
**Reimers, S.,** *See* Tam, C.S., 7:1077
**Reineck, S.,** *See* Freisinger, J., 7:1438
**Reinhardt, J.,** *See* Kirsch, J., 7:1410
*See* Soff, G., 7:1409
**Reisfeld, M.J.,** *See* McDowell, R.S., 7:829
**Reister, D.B.,** Total costs of energy services, 7:611
**Rek, Z.J.,** Colour confinement effects in the presence of nuclear matter, 7:1549
**Rekstad, J.,** Gamma multiplicity of the decay of highly excited low spin states in $^{157}$Gd, 7:1595 (OUP—81-09, pp 39-40)
Search for anti-aligned states in the A approximately 75 region, 7:1588 (OUP—81-09, pp 20-24)
*See* Henriquez, A., 7:1593
**Removille, J.,** *See* Biver, E., 7:871
*See* Pietz, M.R., 7:888
**Reuther, T.C.,** *See* Odette, G.R., 7:1696
**Rhett, D.W.,** Heavy-mineral criteria for subsurface uranium exploration, San Juan Basin, New Mexico, 7:114
**Rhodes, D.,** *See* Garlick, A., 7:861
**Riaza, C.,** *See* Soler, R., 7:52
**Ribeiro, C.C.,** *See* Cullen, T.L., 7:1189
**Ricci, M.V.,** *See* Matera, R., 7:1681
**Rich, J.,** *See* Kirchner, G., 7:89
**Richard, J.M.,** Bound states of heavy quarks, 7:1551 (IPNO-TH—80-49, pp 1-2)
**Richardson, E.K.,** *See* Hale, C.W., 7:869
**Richer, A.,** Electric and magnetic giant resonances of low multipolarity studied with inelastic electron scattering, 7:1556 (JINR-D—4-80-385, pp 89-141)
**Rickards, G.K.,** *See* Haddrell, V.J., 7:884

**Ridd, M.F.,** Petroleum geology west of the Shetlands, 7:47
**Ridgley, J.L.,** Geology and characteristics of uranium mineralzation in Morrison Formation at Dennison-Bunn Claim, Sandoval County, 7:122
**Rieck, P.J.,** Integrated structural design of nuclear power plants for high seismic areas, 7:587
**Riedel, M.R.,** *See* Pietz, M.R., 7:888
**Rieger, M,** *See* Biggio, M., 7:1684
**Riese, W.C.,** Scanning-electron-microscope investigation of paragenesis of uranium deposits, Mount Taylor and elsewhere, Grants Mineral Belt, 7:119
**Riklis, E.,** Are we at risk from low-level radiation. DNA repair capacity as a probe of potential damage and recovery, 7:1180
**Riley, G.H.,** Granite ages in the Pine Creek Geosyncline, 7:1253
Natural reactor studies, 7:78
Rb-Sr chronology of micas at Jabiluka, 7:1261
**Ringwood, A.E.,** Isotopic and crystallographic studies of alpha irradiated SYNROC minerals, 7:728
Recent progress on SYNROC development, 7:205
**Ripa, M.,** *See* Vana, J., 7:1456
**Ripken, H.W.,** *See* Fahr, H.J., 7:1311
*See* Petelski, E.F., 7:1312
**Ristorcelli, S.J.,** Geology of eastern Smith Lake ore trend, Grants mineral belt, 7:110
**Ritchie, A.B.,** *See* Brown, P.E., 7:868
**Ritterbusch, S.E.,** *See* Pati, S.R., 7:553
**Rizkalla, S.,** Test of a model of a thin-walled prestressed concrete secondary containment structure, 7:388
**Roarty, M.J.,** *See* Crick, I.H., 7:70
*See* Needham, R.S., 7:1257
**Robbins, J.M.,** Gas content measurements of irradiated coated particles using the PGA system, 7:747
**Roberts, D.G.,** Continental margin from the Porcupine Seabight to the Armorican marginal basin, 7:51
**Roberts, J.H.,** *See* Gold, R., 7:293
**Roberts, R.A.,** *See* Gliddon, B.J., 7:248
**Roberts, R.M.,** Applications of isotopic labeling to the study of Friedel-Crafts reactions. Chapter 3, 7:827
**Robertson, I.I.,** *See* Watkins, M.L., 7:1677
**Robertson, M.E.A.,** *See* Sharland, C.J., 7:773
**Robinson, K.W.,** Fastnet Basin: an integrated analysis, 7:50
**Robinson, S.I.,** *See* O'Brien, D.W., 7:1708
**Robinson, W.,** *See* Clegg, B., 7:1007
**Roche, A.,** Arterial therapeutic angiography in liver pathology, 7:1091
Therapeutic angiography in acute processes of the alimentary tract, 7:1089
**Roche, M.F.,** *See* Tomczuk, Z., 7:608
**Rochow, K.A.,** Seismic stratigraphy of the North Sea Palaeocene deposits, 7:33
**Rodin, A.V.,** Electron energy distribution function for copper vapour, 7:893
**Rodionov, Yu.F.,** *See* Zelenkov, A.G., 7:1598
**Rodriguez, C.,** Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.2. Three-dimensional analysis of the temperature and stress fields in a HHT vessel, including effects of the thermal creep, 7:334 (IWGHTR—2, pp 33-43)
**Roeckl, E.,** *See* Peuser, P., 7:1590
**Roennberg, G.,** *See* Bergenlid, U., 7:491
**Rogers, J.W.,** Proton-recoil neutron spectroscopy at the Pool Critical Assembly, 7:540 (EUR—6813(Vol.2), pp 1051-1061)
**Rogers, P.S.Z.,** High-temperature thermodynamic properties of aqueous sodium sulfate solutions, 7:812
**Rohrbeck, W.,** Behaviour of carbon fibre cathodes in vacuum discharges, 7:1447
**Rolstad, E.,** Progress with the probabilistic fuel failure code POSHO, 7:486 (IWGFPT—7, pp 252-259)
**Rolston, D.E.,** Denitrification as affected by irrigation frequency and applied herbicides, 7:1002
**Roman, D.,** *See* Airey, P.L., 7:1017
**Romander, C.M.,** *See* Colton, J.D., 7:856
**Romanova, I.N.,** *See* Dynnik, M.S., 7:1234
*See* Samsonova, L.A., 7:1219
**Romas', R.S.,** Peculiarities of liver affection in chronic alcoholic intoxication according to the data of radioisotopic and biochemical study methods, 7:1116
**Rompolt, B.,** *See* Michels, D.J., 7:1348
**Ronnevik, H.C.,** Geology of the Barents Sea, 7:45
*See* Day, G.A., 7:17
**Rook, H.L.,** *See* Becker, D.A., 7:758
**Roos, G.,** *See* Hartwig, S., 7:176
**Rosen, V.,** Stimulation of $^{45}Ca$ release from bone by embryonic chick parathyroid glands in vitro, 7:1175
**Rosenau, P.,** Two-fluid theory of interplanetary shock waves, 7:1342
**Rosinger, H.E.,** Development of a burst criterion for Zircaloy fuel cladding under LOCA conditions, 7:550 (IWGFPT—7, pp 21-36)
**Ross, A.B.,** *See* Greenstock, C.L., 7:838
**Ross, R.,** Problems of producing homogeneously doped silicon by neutron irradiation, 7:713 (INIS-mf—6449, pp vp)
**Ross, W.,** Investigation of some processes in the hydrogen laser plasma, 7:891
**Rossi, P.,** *See* Simonetti, G., 7:1092
**Rossiter, A.G.,** Proterozoic tectonic model for northern Australia and its economic implications, 7:1258
**Roth, E.P.,** Effect of soiling on solar mirrors and techniques used to maintain high reflectivity, 7:264
*See* Pettit, R.B., 7:263
**Rottman, G.J.,** Measurements of mass flow in the transition region and inner corona, 7:1345
**Rouault, J.,** *See* Cytermann, R., 7:413
**Rougeau, J.P.,** Enrichment industry reaches maturity, 7:186
**Routti, J.T.,** Multialgorithm unfolding studies of neutron spectra from activation detectors, 7:437 (EUR—6813(Vol.2), pp 779-786)
**Rovighi, L.,** *See* Simonetti, G., 7:1092
**Rowntree, J.C.,** *See* Taylor, G.H., 7:98
**Roy, D.,** *See* Sarkar, S.K., 7:687
**Roy, G.K.,** *See* Chakrabarti, B.K., 7:1652
**Roy, P.R.,** *See* Bahl, J.K., 7:341
*See* Ganguly, C., 7:419
*See* Sahoo, K.C., 7:277
**Roy, R.,** Matrix-encapsulated waste forms: application to idealized systems, commercial and SRP/INEL wastes, hydrated radiophases and encapsulant phases, 7:206
**Rozhkov, V.V.,** *See* Gann, V.V., 7:1641
**Rozumbersky, A.,** *See* Fresl, M., 7:648
**Rubashkin, A.L.,** *See* Bochek, G.L., 7:1640
**Rubinacci, G.,** *See* Biggio, M., 7:1684
**Rudakov, N.P.,** *See* Naumova, G.M., 7:1227
**Ruddy, F.H.,** *See* Gold, R., 7:293
**Rudolph, G.,** Leach and corrosion tests under normal and accident conditions on cement products from simulated intermediate level evaporator concentrates, 7:213
**Rueckl, R.,** Energy flow and energy-energy pattern in deep inelastic scattering, 7:1539
**Ruegheimer, E.,** Seventh world congress of anaesthesiologists, 7:1203
**Ruf, M.,** *See* Huebel, K., 7:1037
**Ruf, R.,** Design and fabrication to assure vessel integrity, 7:458
**Ruis, I.A.M.,** *See* Cardozo, P.L., 7:1088
**Rukmani, K.,** NQR spectrometer with AGC and sideband suppression, 7:970
**Runnells, D.D.,** Applications of computer modeling to the genesis, exploration, and in-situ mining or uranium and vanadium deposits, 7:148
**Rusakov, S.V.,** *See* Belousov, A.S., 7:1576
**Russell, A.I.,** *See* O'Keefe, J.M., 7:350
**Rustagi, R.S.,** *See* Chhatre, A.G., 7:385
*See* Das, M., 7:381
**Rutsch, F.,** *See* Francke, K.P., 7:508
**Ryabchikov, L.N.,** *See* Amonenko, V.M., 7:655
*See* Khorenko, V.K., 7:450
**Ryall, W.R.,** Mercury distribution in the Jabiluka Two orebody and its host rocks, 7:1273
**Ryan, R.K.,** *See* Reeve, K.D., 7:708
**Ryding, G.,** New dose control technique for ion implantation, 7:1388
**Rykov, V.I.,** *See* Garkusha, V.I., 7:909
**Rysik, N.S.,** *See* Gusev, D.I., 7:1039
**Ryskamp, J.M.,** Sensitivity of light water reactor fuel cycle parameters and costs to uncertainties in thermal nuclear data and methods, 7:407
**Rytsoelae, K.,** *See* Hautojaervi, P., 7:1437
**Ryumin, S.P.,** *See* Basilova, R.N., 7:1383
**Rzaev, R.A.,** *See* Garkusha, V.I., 7:909

## S

**Sacchetti, N.,** *See* Matera, R., 7:1681
**Sachan, S.R.,** Decontamination and modification of liquid scintillators, 7:960
**Sachdev, S.C.,** Mineralogical variations across Mariano Lake roll-type uranium deposits, McKinley County, 7:112
**Sadakov, O.S.,** *See* Gokhfeld, D.A., 7:692
**Sadchikov, V.D.,** *See* Mel'nikova, S.M., 7:1215
*See* Mikhajlov, P.A., 7:1223
**Sade, N.,** Para-hydroxybenzoic acid and a hypoxic radiosensitizer in bacterial cells, 7:1191
**Sadowski, A.,** *See* Donten, K., 7:317

**Saettele, J.M.,** Elasto-plastic analysis of nozzle intersections in reactor containments, 7:319
**Safarcik, K.,** Complex diagnosis of thyroid gland disease by in vitro tests without using expensive commercial kits, 7:1110 (INIS-mf—6419, pp vp)
*See* Zavada, M., 7:1053
**Safronova, U.I.,** Correlated two-electron transitions into doubly-ionized K-shell, 7:1407
**Sagat, S.,** *See* Holt, R.A., 7:654
**Sagayama, Y.,** *See* Kohata, Y., 7:424
**Saha, B.,** *See* Chitambar, S.A., 7:780
**Saha, D.,** *See* Markandeya, S.G., 7:225
**Sahney, B.N.,** Polynomial and spline approximation. Theory and applications, 7:1671
**Sahoo, K.C.,** Pellet-clad interaction observations in boiling water reactor fuel elements, 7:277 (IWGFPT—8, pp 9-13)
**Sairanen, R.T.,** *See* Mattila, L.J., 7:477
**Saito, H.,** *See* Ichikawa, M., 7:483, 7:501
*See* Ito, K., 7:479
**Sakaguchi, K.,** *See* Imai, Y., 7:1174
**Sakaguchi, Y.,** *See* Susukida, H., 7:665
**Sakai, K.,** *See* Iida, K., 7:670
**Sakakibara, T.,** *See* Yamada, J., 7:1478
**Sakharov, V.P.,** *See* Garkusha, V.I., 7:909
**Sako, K.,** Stress analysis of blanket vessel for JAERI experimental fusion reactor, 7:1699
**Sakon, T.,** *See* Asada, Y., 7:664
**Saksagansky, G.L.,** *See* Mazul, I.V., 7:1679
**Sakudo, N.,** High-current ion implanter for industrial use, 7:1387
**Sakurai, T.,** Energy storage and instability in magnetic flux tubes, 7:1334
**Salati, E.,** Utilization of natural isotopes in the study of salination of the waters in the Pajeu River Valley, northeast Brazil, 7:1019
**Salem, O.,** Groundwater flow patterns in the western Libyan Arab Jamahiriya evaluated from isotopic data, 7:1021
**Saliege, J.F.,** *See* Fontes, J.C., 7:1026
**Saltsman, R.D.,** *See* Kost, J.A., 7:4
**Salvatores, M.,** *See* Carta, M., 7:544
*See* Estiot, J.C., 7:451
**Salvy, J.,** Matrix methods in the optical model. Spherical nuclei, 7:1606 (IAEA-SMR—43, pp 121-148)
**Saly, S.,** *See* Bienik, J., 7:58
**Sampath, N.,** *See* Tucker, D.H., 7:1264
**Samsonov, B.V.,** Peculiarities of investigations in reactor channels, 7:541 (KFTI—78-64, pp 55-67)
**Samsonova, L.A.,** Analysis of chromosomal aberrations of leukocytes of peripheric blood in patients with depression of different genesis hematopoiesis, 7:1219
**Samsur, S.K.,** *See* Behera, S.N., 7:1653
**Samuleva, S.V.,** Morphological and biochemical changes in genesis of postradiation interphase cell killing, 7:1210
*See* Simonova, L.I., 7:1209
**Samuni, A.,** *See* Shani, J., 7:1199
**Sandahl, I.,** Electron spectra over discrete auroras as measured by the substorm-GEOS rockets, 7:1376 (ESA-SP—152, pp 257-262)
*See* Eliasson, L., 7:1377
**Sandberg, J.V.,** *See* Routti, J.T., 7:437
**Santos, J.M.,** Intervention radiology in pulmonary thrombo-embolic disease (PTED), 7:1093
**Sar, M.,** *See* Clark, S.A., 7:1071
**Sarana, V.D.,** *See* Dejneko, A.S., 7:935
**Sarbach, J.,** *See* Briot, F., 7:1186
**Sarkadi, L.,** *See* Mukoyama, T., 7:1399
**Sarkar, G.,** *See* Cartz, L., 7:719
**Sarkar, S.,** Evaluation of relativistic and nonrelativistic DWBA scattering amplitude using wave functions calculated with the help of Green's function, 7:1630
**Sarkar, S.K.,** Potential model for covalent crystals, 7:736
Unified study of static and dynamic properties of alkali metals, 7:687
**Sarma, P.R.,** Constant velocity Moessbauer spectrometer free of long-term instrumental drifts in the count rate, 7:969
**Sarychev, A.K.,** Renormalization group method for the calculation of the conductivity of a dense weakly ionized plasma, 7:1477
*See* Lagar'kov, A.N., 7:1476
**Sasagawa, K.,** *See* Aihara, S., 7:576
**Sasaki, Y.,** Corrosion of nuclear graphites with water vapor in helium, 7:731
**Sastry, C.V.,** Large decametric wavelength antenna array for IPS observations of radio sources, 7:1351
**Sataka, M.,** Measurements of double differential cross sections for electrons ejected by 5 - 20 keV $H^+$, $H_2^+$ and $He^+$ impacts on argon, 7:1405
*See* Nakai, Y., 7:1417
**Sato, H.,** Theoretical study of electron spectra ejected by molecular autoionization in He + $He^{2+}$ collision, 7:1423
**Sato, T.,** *See* Nuno, H., 7:472
**Satoh, K.,** *See* Fujii, K., 7:526
**Satoh, M.,** *See* Iida, K., 7:670
*See* Susukida, H., 7:665
**Satoh, S.,** *See* Aihara, S., 7:576
**Satou, J.,** *See* Fujii, K, 7:530
**Satou, M.,** *See* Fujii, K, 7:530
**Satya Murthy, N.S.,** *See* Chopra, V., 7:1659
**Sauar, T.O.,** *See* Rolstad, E., 7:486
**Saucier, A.E.,** Tertiary oxidation in Westwater Canyon member of Morrison formation, 7:1262
*See* Kozusko, R.G., 7:120
**Savino, E.J.,** *See* Harriague, S., 7:384
**Savitskii, G.A.,** Problem of monopole resonance in nuclei, 7:1623 (KFTI—79-48, pp 53-54)
**Savoy-Navarro, A.,** Discussion of the CDHS charged current results, 7:1538
**Sawamura, A.,** *See* Narita, M., 7:937
**Sawant, H.S.,** Estimation of shock thickness from dynamic spectra of type II bursts, 7:1330
*See* Degaonkar, S.S., 7:1323
**Scaiano, J.C.,** *See* Das, P.K., 7:833
**Scharpenberg, R.,** *See* Baro, G., 7:307
**Scharre, D.L.,** Observation of the radiative transition PSI $\rightarrow \gamma$E(1420), 7:1489
**Schatten, K.H.,** Origin of interplanetary sectors, 7:1299
**Schelling, G.,** *See* Walther, R., 7:335
**Schenk, W.,** *See* Groos, E., 7:356
**Schimmelpfennig, K.,** Experiences with testing PCRV concrete and epoxy resin models, 7:448 (IWGHTR—2, pp 161-175)
*See* Schnellenbach, G., 7:371
**Schindler, D.W.,** *See* Quay, P.D., 7:1028
**Schindlmeier, W.,** *See* Heumann, K.G., 7:765
**Schipper, M.R.,** *See* Kelly, T.E., 7:233
**Schladot, J.D.,** Mass spectrometric determination of lead isotopes in West German pit coal, 7:1
**Schlafer, W. III,** Seismic response comparisons for an embedded high temperature gas-cooled reactor (HTGR) on a high seismic site, 7:592
**Schlechtendahl, E.G.,** *See* Katz, F., 7:583
*See* Schumann, U., 7:579
**Schlesinger, T.,** *See* Dukhan, R., 7:986
*See* Kuszpet, M.E., 7:959
*See* Tadmor, J., 7:632
**Schmahl, E.J.,** Disruption of EUV coronal loops following a mass ejection transient, 7:1327
**Schmidt, E.,** *See* Zamorani, E., 7:187
**Schmidt, G.,** *See* Gloeckner, H.J., 7:593
**Schmidt, J.J.,** Nuclear data needs and related activities of the IAEA nuclear data section, 7:1557 (ZfK—410, pp 130-139)
**Schmieder, B.,** Dynamics of a quiescent filament, 7:1321
**Schmitt, W.,** Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:311
Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:331
*See* Schueller, G.K., 7:578
**Schnatz, G.,** *See* Hartwig, S., 7:176
**Schneider, J.C.,** Control and operation of the SUPER PHENIX steam generators, 7:425
**Schneider, K.,** Environmental impact of plutonium transport in the event of accidents within the European Community. Estimation of potential releases, 7:175 (INIS-mf—6447, pp vp)
*See* Anspach, W., 7:173
**Schnellenbach, G.,** Aspects on the design of modern PCRV with respect to the HHT-vessel, 7:371
Non-linear calculation of PCRV using dynamic relaxation, 7:447 (IWGHTR—2, pp 126-136)
*See* Schimmelpfennig, K., 7:448
**Schoeffel, K.,** *See* Leyden, M., 7:1159
**Schoeneich, H.,** *See* Day, G.A., 7:17
**Schoening, J.,** Characteristics of the prestressed concrete reactor vessel of the HHT demonstration plant, 7:332 (IWGHTR—2, pp 1-14)
Characteristics of the PCRV of the HHT demonstration plant, 7:374
**Scholfield, P.,** *See* Blanchard, A., 7:362
**Scholz, R.,** Relationship between technical standards and legal norms, with special regard to the building law, 7:1712
**Schott, R.,** Hydrogen isotope analysis by low resolution mass spectrometry, 7:766
**Schreiber, H.D.,** Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses, 7:201
**Schroeder, F.H.,** Steroid receptors, metabolism and prostatic cancer. Workshop of the Society of Urologic Oncology and Endocrinology, Amsterdam, Netherlands, April 27-28, 1979, 7:1099

**Schubert, M.,** *See* Donnerhacke, K.H., 7:890
**Schubert, W.,** *See* Mathieu, F., 7:929
**Schuchmann, K.W.,** *See* Baro, G., 7:307
**Schueller, G.K.,** Some aspects of the interaction between systems- and structural reliability, 7:578
**Schultz, J.,** *See* Smith, D.W., 7:1486
**Schulz, R.B.,** *See* Arbo, J.C., 7:638
**Schulz, W.W.,** Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
**Schumann, U.,** Analysis of the RS16B experiment on fluid-structure interactions during PWR blowdown, 7:581
Fluid-structure interactions in PWR vessels during blowdown. Code development at Karlsruhe and results, 7:579
*See* Ludwig, A., 7:584
**Schunck, J.,** *See* Thiele, B.A., 7:352
**Schuren, H.,** *See* Heinzelmann, M.F.M., 7:958
**Schuss, J.J.,** Lower hybrid heating in the Alcator A tokamak, 7:1675
**Schuster, H.,** *See* Ennis, P.J., 7:380
**Schuster, L.,** *See* Bradley, F.J., 7:991
**Schuyleman, S.F.,** *See* De'Ath, N.G., 7:41
**Schwartz, F.W.,** Evaluation of the ability to predict radionuclide transport in groundwater flow systems, 7:228
**Schwarzinger, G.,** *See* Dobrozemsky, R., 7:658
**Schwiers, H.G.,** Feasibility of a multicavity PCPV with elastic hot liner for HTR, 7:373
*See* Lethert, E.K., 7:375
*See* Schoening, J., 7:332, 7:374
**Scibac, W.,** *See* Donten, K., 7:317
**Scott, D.K.,** Nuclear collisions at intermediate energies, 7:1617 (JINR-D—4-80-385, pp 297-336)
**Scott, D.R.,** *See* White, P.R., 7:259
**Seager, C.H.,** *See* Ginley, D.S., 7:256
**Seagren, R.D.,** Motor carrier routing using the COMPU.MAP program, 7:172 (INIS-mf—6447, pp vp)
**Seal, A.K.,** *See* Ganguly, C., 7:419
**Sebata, M.,** *See* Kamiya, M., 7:1415
**Sedel'nikov, V.A.,** Metallographic investigation into interaction of cesium with some metals, 7:701
**Sedlet, J.,** Migration of radionuclides following shallow land burial, 7:231
**Seeliger, D.,** Application of pre-equilibrium decay models to the calculation of neutron reaction data, 7:1611 (IAEA-SMR—43, pp 283-291)
**Segawa, T.,** *See* Kaneko, H., 7:220
**Seidel, A.,** Retention and effects of $^{239}Pu$ in the tree shrew (Tupaia Belangeri), 7:1182
*See* Winter, R., 7:1183
**Seidel, B.I.,** *See* Bird, M.K., 7:1357
**Seidowski, E.,** *See* Ledovskoy, V.P., 7:1463
**Seki, S.,** *See* Kudo, H., 7:1429
**Sekiguchi, A.,** *See* Nakazawa, M., 7:436
**Sekine, T.,** *See* Ohashi, N., 7:668
**Self, S.A.,** *See* Annen, K.D., 7:634
**Seliger, K.,** *See* Bohmeyer, W., 7:1442
**Selivanov, V.M.,** Utilization of thermocouple random signal correlation method for coolant flow rate measuring in nuclear power plants, 7:453
**Sen, D.,** *See* Sarkar, S.K., 7:687
**Sen, P.,** Studies of forensic related trace elemental problems by the particle induced X-ray emission (PIXE) method, 7:777
**Sen, S.,** *See* Sen, P., 7:777
**Senachenko, V.S.,** *See* Safronova, U.I., 7:1407
**Sengupta, S.,** *See* Basu, A.N., 7:735
*See* Chakrabarti, S.K., 7:733
*See* Ghosh, S., 7:710
*See* Sarkar, S.K., 7:736
**Senot, J.,** Theorical study and modelling of fuel cladding interaction and stress corrosion concerning the light water reactor fuel elements, 7:298 (IWGFPT—7, pp 168-172)
**Seppae, E.K.,** Modelling of overpower transients with Gapcon-Thermal-3 code, 7:554 (IWGFPT—8, pp 203-225)
**Sera, K.,** K, L and M shell ionizations in the energy region E/lambda U > 1, 7:1400
**Serebrennikov, D.V.,** *See* Mazul, I.V., 7:1679
**Sergeev, G.I.,** *See* Moskalev, V.A., 7:922, 7:923, 7:924
**Sermulina, B.J.,** Gasdynamics of impulsive heated solar plasma, 7:1360
**Sermulinya, B.Ya.,** Substance ejection and shock waves on solar plasma pulsed heating, 7:1284 (INIS-mf—6385, pp 153-154)
**Serrano, J.R.,** Mining of the uraniferous shales of Saelices el Chico (Salamanca), 7:152
**Sethunathan, N.,** Effects of combined pesticides application on their persistence in flooded rice soils, 7:1004
**Setlow, J.K.,** *See* Cabrera-Juarez, E., 7:1204
**Sevast'yanov, V.N.,** *See* Aitbaev, F.B., 7:1277
**Severin, N.F.,** *See* Gorenko, A.F., 7:743
**Sexton, F.W.,** *See* Garner, C.M., 7:250
**Shabashov, V.I.,** *See* Bronin, S.Ya., 7:1462
**Shah, G.C.,** *See* Vartak, D.G., 7:784
**Shah, R.R.,** Distributed terminal support in a data acquisition system for nuclear research reactors, 7:536 (AECL—7056, pp 226-238)
**Shakhov, B.A.,** *See* Dorman, L.I., 7:1281
**Shamai, Y.,** *See* Dukhan, R., 7:986
**Shamov, A.I.,** Automated nuclear geophysical instruments, 7:769
**Shani, J.,** Sustained release of radioprotective agents in vitro, 7:1199
**Shannon, P.M.,** *See* Robinson, K.W., 7:50
**Shannon, T.E.,** USA/TNS programs. Engineering considerations, 7:1682
**Shantyr', V.I.,** Molecular and endocrine mechanisms of postradiation changes in reactivity of bone tissues, 7:1211
*See* Mamotyuk, E.M., 7:1225
**Shaokang, H.,** *See* Fei, Q., 7:134
**Shapiro, A.I.,** Phenomena taking place on the electrode surface in vacuum gap at high voltages, 7:1451
*See* Pokrovskaya-Soboleva, A.S., 7:1450
**Shapiro, I.S.,** Structure of baryonium and its manifestation in multiparticle production processes, 7:1518
**Sharejko, P.N.,** *See* Belousov, A.S., 7:1576
**Sharkova, O.P.,** *See* Aksenov, M.S., 7:1444
**Sharland, C.J.,** High-precision automated beta/gamma technique for uranium ore analysis, 7:773
**Sharma, A.K.,** *See* Sarma, P.R., 7:969
**Sharma, A.P.,** *See* Gomber, K.L., 7:965
*See* Singh, V.P., 7:964
*See* Yadav, J.S., 7:967
**Sharma, G.K.,** *See* Tiwari, M.D., 7:688
**Sharma, R.G.,** *See* Bhide, V.G., 7:1660
**Sharpe, R.M.,** Calibration of silicon carbide temperature monitors in a fast reactor, 7:411
**Sharvina, K.N.,** *See* Basilova, R.N., 7:1383
**Sharypin, V.I.,** *See* Selivanov, V.M., 7:453
**Shchapov, G.A.,** *See* Boguslyavskij, V.B., 7:470
**Shchelkunova, L.I.,** *See* Grachev, S.A., 7:836
**Shebeko, A.V.,** *See* Berezovoj, V.P., 7:1577
*See* Ganenko, V.B., 7:1559
*See* Korchin, A.Yu., 7:1560
**Shebeko, K.V.,** Proton inelastic scattering by sup(72,74)Ge nuclei, 7:1587 (KFTI—79-40, pp 3-4)
**Sheeley, N.R. Jr.,** Solar observations with a new Earth-orbiting coronagraph, 7:1297
*See* Michels, D.J., 7:1348
**Shelke, R.N.,** *See* Bhatnagar, A., 7:1326
**Shennan, J.V.,** Radiolytic carbon gasification, 7:840
**Shepelenko, A.A.,** *See* Vorontsov, S.S., 7:1443
**Sheppard, D.B.,** *See* Mansour, M.N., 7:845
**Sheppard, S.M.F.,** *See* Pagel, M., 7:90
**Sherbourne, A.N.,** *See* Krishnasamy, S.G., 7:469
**Sheridan, K.V.,** Evidence for open field lines from active regions: short communication, 7:1331
Radio observations of coronal holes, 7:1294
*See* Jackson, B.V., 7:1346
**Sherman, I.S.,** *See* Strauss, M.G., 7:1001
**Shestakov, V.G.,** *See* Moskalev, V.A., 7:922, 7:923, 7:924
**Shestopalov, I.P.,** *See* Vakulov, N.V., 7:1278
**Sheverdin, Yu.P.,** *See* Natarov, V.V., 7:1107
**Shevkunov, S.V.,** *See* Vorontsov-Veliaminov, P.N., 7:1474
**Shibata, H.,** *See* Kanda, K., 7:543
**Shikata, H.,** *See* Nagakura, T., 7:174
**Shima, K.,** Inner shell ionization in the collision system of $Z_1 << Z_2$, 7:1401
**Shimada, T.,** *See* Ochs, W., 7:1511
**Shimizu, S.,** *See* Ito, S., 7:1402
**Shindo, M.,** Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**Shingai, K.,** *See* Asada, Y., 7:664
**Shinohara, K.,** Measurement of absorbed dose-rate in skin for low-level beta-rays, 7:953
**Shirai, T.,** *See* Nakai, Y., 7:1398, 7:1417
**Shiraki, K.,** Vibrational characteristics of primary reactor coolant system, 7:591
**Shiroya, S.,** *See* Woodruff, W.L., 7:542
**Shirvington, P.J.,** $^{234}U/^{238}U$ activity ratios in clay as a function of distance from primary ore, 7:132
**Shiryaev, V.N.,** *See* Boguslyavskij, V.B., 7:470
**Shleien, B.,** Protective action guides. Theory and application lessons from the Three Mile Island accident, 7:989
**Shramenko, B.I.,** *See* Bochek, G.L., 7:1640
**Shubaly, M.R.,** High-current DC heavy-ion source, 7:1395

*See* Hepburn, J.D., 7:918
**Shubko, V.M.,** *See* Zelenkov, A.G., 7:1598
**Shui, V.H.,** Removal of SOx and NOx from flue gases by electron radiation, 7:984
**Shul'ga, A.I.,** Comparative evaluation of treatment of patients with syringomyelia with X-rays and radioactive iodine, 7:1236
**Shurupova, E.N.,** *See* Samsonova, L.A., 7:1219
**Shuryak, E.V.,** Theory of QCD plasma and hadronic collisions, 7:1541
**Shust, I.V.,** Changes in morphological and cytochemical indices of peripheral blood in white rats following combined effect of permanent magnetic field and ionizing radiation, 7:1228
**Shutilova, A.A.,** *See* Zhidovtseva, M.I., 7:1240
**Sibbald, T.I.I.,** *See* Hoeve, J., 7:87
**Sidora, V.D.,** *See* Shul'ga, A.I., 7:1236
**Siemroth, P.,** Influence of surface contamination on cathode erosion by nanosecond discharges in vacuum, 7:1448
**Sievers, A.J.,** Emissivity of metals, 7:265
Fundamental limits to the spectral selectivity of composite materials, 7:266
**Sigaud, G.M.,** *See* Paschoa, A.S., 7:1190
**Siggins, A.F.,** *See* McKavanagh, B.M., 7:5
**Sil, N.C.,** Charge transfer in proton-hydrogenlike ion collision in a modified coulomb-born approximation, 7:1419
**Silbermann, M.,** *See* Eilam, Y., 7:1074
**Sills, H.E.,** *See* Holt, R.A., 7:654
**Simeon, C.,** *See* Perrin, J., 7:421
**Simmonds, S.H.,** *See* Rizkalla, S., 7:388
**Simonetti, G.,** Angiographic renal embolization: indications and results, 7:1092
**Simonova, L.I.,** Operative intervention effect on hematopoietic state in irradiated rats, 7:1209
*See* Mikhajlov, P.A., 7:1223
*See* Samuleva, S.V., 7:1210
**Simons, R.I.,** *See* Guthrie, G.L., 7:433
**Simonsen, H.A.,** Impact of new technology on the economics of uranium production from low-grade ores, 7:156
**Simpson, C.J.,** Study of the Pine Creek Geosyncline using integrated Landsat and Aeromagnetic data, 7:1256
**Simpson, J.A.,** Gamma scanning of full scale HTR fuel elements, 7:351
**Simpson, R.D.H.,** Geological input to reservoir simulation of the Brent Formation, 7:37
*See* Parry, C.C., 7:29
**Sinclair, W.,** *See* Ringwood, A.E., 7:728
**Singh, A.,** *See* Chaki, S.K., 7:394
**Singh, G.S.,** *See* Auluck, S., 7:1655
**Singh, M.,** *See* Ahmad, S., 7:1643
**Singh, R.R.,** Need for accurate deuterium analysis in a heavy water plant and its achievement, 7:245
**Singh, V.P.,** Effect of annealing on fission fragment tracks in soda glasses, 7:964
*See* Gomber, K.L., 7:965
*See* Yadav, J.S., 7:967
**Sinha, C.,** *See* Sil, N.C., 7:1419
**Sinha, K.K.,** *See* Balakrishna, P., 7:287
**Sinha, S.,** *See* Manjunath, C.V., 7:971
**Sinha, S.K.,** *See* Chakrabarti, B.K., 7:1652
**Sinilova, N.G.,** *See* Tumanyan, M.A., 7:1139
**Sipush, P.J.,** *See* Fici, J.A., 7:304
**Sivaramakrishnan, K.S.,** *See* Bahl, J.K., 7:341
*See* Sahoo, K.C., 7:277
**Skaali, B.,** *See* Rekstad, J., 7:1595
**Skalyo, J. Jr.,** *See* Growcock, F.B., 7:732
**Skibin, D.,** Structure of flow and turbulence in the stable atmospheric surface layer, 7:979 (IA—1356, pp 278-279)
**Skinner, J.,** *See* Hines, G.F., 7:344
**Skinner, R.F.,** Oxidation of carbonacecus deposit in nuclear reactors, 7:365
*See* Norfolk, D.J., 7:839
**Skiver, J.,** *See* Correia, J.A., 7:1087
**Sklyarov, V.P.,** *See* Boguslyavskij, V.B., 7:470
**Skolka, J.,** *See* Dana, J., 7:978
**Skripko, V.A.,** *See* Davydova, L.I., 7:1104
**Skripnik, L.D.,** *See* Kogan, I.A., 7:1217
**Skul'skaya, M.I.,** *See* Pakhomov, P.L., 7:968
*See* Zhidovtseva, M.I., 7:1216
**Skull, G.,** *See* Schneider, J.C., 7:425
**Skvarla, M.F.,** Thermal conductivity of selected repository minerals, 7:197
**Slabospitsky, S.R.,** *See* Kartvelishvili, V.G., 7:1519, 7:1520
**Slade, P.G.,** *See* Emtage, P.R., 7:1453
**Sliepcevic, A.,** *See* Srdoc, D., 7:1020
**Slouka, V.,** *See* Kimlova, I., 7:1061
**Smallcalder, R.,** *See* Haddrell, V.J., 7:882
**Smith, D.A.,** Geology and recognition of a relict uranium deposit in Sec. 28, T. 14 N., R. 10 W., Southwest Ambrosia Lake Area, McKinley County, 7:116
**Smith, D.W.,** Production in anti p - d interactions below 1 GeV/c, 7:1486 (TRI—79-1, pp 105-108)
**Smith, E.,** Implications of recent developments in the plastic fracture mechanics field to the PCI stress corrosion problem, 7:481 (IWGFPT—7, pp 190-195)
**Smith, G.,** *See* Dawson, J.T., 7:513
**Smith, I.,** *See* Schwartz, F.W., 7:228
**Smith, R.,** Trace organics in AGR coolants, 7:367
**Smith, R.F.,** *See* Miller, K.J., 7:640
**Smith, T.F.,** Protein constraints induced by multiframe encoding, 7:1069
**Smith, W.,** *See* Dawson, W.K., 7:1709
**Smith, Z.,** *See* Tanaka, K., 7:1325
**Smushkov, I.V.,** *See* Fenkel', L.A., 7:1207
**Snelling, A.A.,** Uraninite and its alteration products, Koongarra uranium deposit, 7:81
*See* Dickson, B.L., 7:82
**Sobotka, J.,** *See* Konecny, A., 7:403
**Soff, G.,** Theory of inner-shell vacancy formation in superheavy quasimolecules, 7:1409
*See* Kirsch, J., 7:1410
**Sogame, M.,** *See* Ito, K., 7:479
**Sojka, J.,** Radiometric gage for ash content monitoring in solid fuels, 7:973 (INIS-mf—6422, pp vp)
**Sokolova, M.V.,** Some peculiarities of a gas discharge in a gap with dielectric, 7:1465
**Sokolovskii, I.L.,** *See* Kulakov, V.M., 7:1597
**Soldatov, A.N.,** *See* Elaev, V.F., 7:894
**Soler, R.,** Petroleum geology of the Bay of Biscay, 7:52
**Solopov, A.P.,** *See* Selivanov, V.M., 7:453
**Solov'ev, Yu.V.,** *See* Belousov, A.S., 7:1576
**Soloviyanchik, D.A.,** *See* Kiselevskii, L.I., 7:1464
**Soman, S.D.,** *See* Sachan, S.R., 7:960
**Somayajulu, G.V.S.R.K.,** *See* Balakrishna, P., 7:287
**Sombret, C.,** *See* Bonniaud, R., 7:211
**Somogyi, G.,** *See* Fulop, M., 7:907
**Somov, B.V.,** Magnetically driven motions in solar corona, 7:1359
*See* Sermulina, B.J., 7:1360
*See* Sermulinya, B.Ya., 7:1284
*See* Syrovatskii, S.I., 7:1354
**Sonntag, C.,** Environmental isotopes in North African groundwaters; and the Dahna sand-dune study, Saudi Arabia, 7:1016
**Soo, P.,** *See* Aronson, S., 7:683
**Soran, P.D.,** *See* Cort, C.E., 7:1702
**Soru-Escaut, I.,** *See* Schmieder, B., 7:1321
**Souffrin, P.,** *See* Couturier, P., 7:1304
**Soulat, P.,** *See* Alberman, A., 7:289
**Soya, I.,** *See* Iida, K., 7:670
**Spadoni, M.,** *See* Matera, R., 7:1681
**Spalding, B.P.,** Precipitation of radiostrontium in soil, 7:1008
**Spandick, W.,** Basic design of the Krupp heat-insulating system with hot liner for PCPVs of HTRs, 7:445 (IWGHTR—2, pp 79-83)
Study on thermal fatigue endurance under biaxial stress state, 7:663
**Spear, K.E.,** *See* Potter, P.E., 7:706
**Specht, H.J.,** *See* von Harrach, D., 7:1603
**Speidel, S.R.,** Parametric study on ligament stresses in multi-cavity prestressed concrete reactor vessels (PCRV's), 7:372
**Spektor, A.R.,** *See* Sermulina, B.J., 7:1360
*See* Sermulinya, B.Ya., 7:1284
**Spencer, J.L.,** *See* Arbo, J.C., 7:638
**Spiegel, V.,** *See* Eisenhauer, C.M., 7:295
**Spilker, H.,** *See* Rautenberg, J., 7:377
**Spir'kova, E.S.,** *See* Vakulov, N.V., 7:1278
**Spitsyn, V.I.,** Experimental evaluation of changes in properties of natural minerals under irradiation, 7:215
**Spitzner, K.J.,** Northeast Utilities generic plant computer system, 7:534 (AECL—7056, pp 192-197)
**Spring, A.H.,** High reliability straight tube LMFBR steam generator design, 7:418
**Sprunger, E.,** *See* Bart, G., 7:945
*See* Buergisser, B., 7:862
**Squyres, J.B.,** Origin and significance of organic matter in uranium deposits of Morrison Formation, San Juan Basin, New Mexico, 7:104
**Srdoc, D.,** Isotope investigations as a tool for regional hydrogeological studies in the Libyan Arab Jamahiriya, 7:1020
**Srinivasan, R.,** *See* Bandyopadhyay, A.K., 7:1654
*See* Manjunath, C.V., 7:971
**Srivastava, D.S.,** *See* Khan, A., 7:963
**Stagg, M.S.,** *See* Haddrell, V.J., 7:865
**Stahlkopf, K.E.,** Radiation damage saturation in reactor pressure vessel steel. Data and preliminary model, 7:456
*See* Steele, L.E., 7:459
**Stangenberg, F.,** Impact testing of steel fibre reinforced concrete slabs with liner, 7:376
**Stangrit, P.T.,** *See* Polyakova, L.P., 7:824
**Stankovic, S.,** *See* Begovic, J., 7:1202

**Stanley, C.R.,** *See* Park, R.M., 7:729
**Stansfield, J.M.,** Impact study of a primary sulfate emission source, 7:985
**Star, E.G.,** Gamma-rays and ethylene oxide sterilization. Abstract 226, 7:1178
**Starka, L.,** *See* Dvorak, P., 7:1063
*See* Hampl, A., 7:1062
**Starykh, V.V.,** *See* Winkler, R., 7:1466
**Stasyuk, G.A.,** *See* Shust, I.V., 7:1228
**Steele, J.J.,** *See* Brown, P.E., 7:868
**Steele, L.E.,** Assuring structural integrity of steel reactor pressure vessels, 7:459
**Stegnar, P.,** Radioecology of uranium and radium with special reference to a uranium mining area, 7:1006 (IAEA-TECDOC—229, pp 175-183)
**Stehle, H.,** *See* Peehs, M., 7:503
*See* Vogl, W., 7:498
**Stehlik, J.,** Certain aspects of operation safety of nuclear power plants, 7:547 (INIS-mf—6423, pp vp)
**Stehno, G.,** *See* Duftschmid, K.E., 7:952
**Stein, J.D.,** *See* Storms, H.A., 7:685
**Steinberg, E.,** *See* Peehs, M., 7:503
**Steinert, D.,** *See* Koch, L., 7:165
**Steinitz, R.,** Are solar wind measurements of different spacecraft consistent, 7:1310
*See* Eyni, M., 7:1309
**Steinolfson, R.S.,** Evolution of coronal magnetic structures, 7:1358
*See* Mullan, D. J., 7:1341
**Stelzried, C.T.,** *See* Bird, M.K., 7:1357
**Stepanov, A.V.,** Separation of elements by the electromigration method, 7:790
Use of electromigration method in physicochemical investigations. Chapter 4, 7:823
**Stepanova, V.D.,** *See* Gusev, D.I., 7:1039
**Stephen, W.J.,** Influence of structure on the thermal oxidation of reactor graphites, 7:723
**Stern, P.H.,** Pituitary hormone effects on $^{45}$Ca release from fetal rat bones, 7:1072
**Stewart, R.T.,** Transient disturbances of the outer corona, 7:1343
*See* Duncan, R.A., 7:1347
**Stibunov, V.N.,** *See* Glavanakov, I.V., 7:1575
**Stichler, W.,** *See* Hoetzl, H., 7:1025
*See* Srdoc, D., 7:1020
**Stockton, F.D.,** *See* Horvay, G., 7:598
**Stoeter, P.,** Selective spinal angiography and embolization of tumours of the vertebral column, 7:1094
**Stoever, D.,** New and improved post-irradiation techniques for examination of fission products and actinides in coated particles, 7:348
**Stolpovskii, V.G.,** *See* Basilova, R.N., 7:1383
**Stone, W.J.,** *See* Lyford, F.P., 7:234
**Stoneham, A.M.,** Radiation damage in non-metals, 7:835 (AERE-TP—843, pp 182-190)
**Stora, J.P.,** *See* Bourgeois, P., 7:313
*See* Senot, J., 7:298
**Storini, M.,** *See* Iucci, N., 7:1350
**Storizhko, V.E.,** *See* Dejneko, A.S., 7:935
*See* Shebeko, K.V., 7:1587
*See* Ustimenkov, K.F., 7:1618
**Storms, H.A.,** Enhanced negative secondary ion emission with cesium ion bombardment, 7:685
**Stow, D.A.,** *See* Fraser, A.S., 7:414
**Strack, S.,** *See* Bonotto, S., 7:1192
**Stradal, K.A.,** *See* Duwe, R., 7:355
**Strand, R.C.,** *See* McCal, D., 7:1499
**Stratowa, C.,** *See* Dobrozemsky, R., 7:658
**Strauss, M.G.,** Measurement of radioactivity in Mount St. Helens volcanic ash by x/sub gamma/ ray spectrometry, 7:1001
**Streibl, B.,** Mechanical static analysis of JET vacuum vessel, 7:1700
**Strezov, A.S.,** Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**Stringer, T.E.,** *See* Watkins, M.L., 7:1677
**Strnad, J.G.,** Genetic models and their impact on uranium exploration in the Athabasca sandstone basin, Saskatchewan, Canada, 7:133
*See* Kirchner, G., 7:89
**Stroynowski, R.,** Observation of a direct low-mass $e^+e^-$ continuum in $\pi^-p$ interactions at 16 GeV/c, 7:1488
**Struckel, P.,** Electromagnetic induction pumps for liquid sodium, 7:402 (INIS-mf—6423, pp vp)
**Stuart, D.C.,** *See* Tucker, D.H., 7:1264
**Stuart-Smith, P.G.,** Evolution of the Pine Creek Geosyncline, 7:1251
*See* Needham, R.S., 7:1250, 7:68
**Stubbe, C.,** *See* Orth, K., 7:429
**Stuchlik, S.,** *See* Docekal, J., 7:741
**Stucki, D.,** *See* del Re Brun, R.M.G., 7:1097
**Studenikina, F.G.,** Application of combined ultraviolet and gamma-radiation effect for medical instruments sterilization, 7:1138 (INIS-mf—5673, pp 30-31)
**Studier, F.W.,** *See* Dunn, J.J., 7:1070
**Stuedemann, W.,** Observation of an energetic proton beam and the generation of ULF-waves aboves active auroral forms, 7:1380 (ESA-SP—152, pp 289-291)
**Stumpf, W.E.,** *See* Clark, S.A., 7:1071
**Stuttard, A.,** *See* Banks, D.A., 7:284
**Styczen, J.,** *See* Beck, F., 7:1592
**Suba, P.,** Properties of labelled tyrosine analogs of somatostatine in RIA system, 7:1058 (INIS-mf—6419, pp vp)
*See* Cerman, J., 7:1059
**Subbotin, V.N.,** *See* Shamov, A.I., 7:769
**Sudhakar, B.,** *See* Sethunathan, N., 7:1004
**Suess, S.T.,** *See* Lockwood, G.W., 7:1313
**Sukhorukov, B.Z.,** Peculiarities of stomach injury healing in dogs irradiated with 350 R and non-irradiated, 7:1226
**Sukhovitskii, E.Sh.,** *See* Antsipov, G.V., 7:1601
**Sulc, V.,** Technological research of components and materials using UJV sodium stand, 7:399 (INIS-mf—6423, pp vp)
*See* Masek, V., 7:400
**Sullivan, J.P.,** Turbulence in two-phase flows, 7:904
**Sullivan, L.H.,** *See* Nelson, R.A., 7:558
**Sumerling, R.,** *See* Cross, M.T., 7:512
**Sumi, Y.,** *See* Endo, I., 7:1485
**Sun, S.S.,** *See* Binns, R.A., 7:85
**Sunada, D.K.,** *See* Ethridge, F.G., 7:105
**Sunami, Y.,** *See* Narumi, H., 7:1625
**Sunamoto, D.,** *See* Asada, Y., 7:664
**Sundermann, H.,** *See* Fenyi, S., 7:818
**Sushkin, V.N.,** *See* Bronin, S.Ya., 7:1462
**Susukida, H.,** Evaluations of the criterion for lateral expansion of steels for nuclear components, 7:665
**Sutherland, M.W.,** Catalase and superoxide dismutase levels in radiation resistant strains of D. melanogaster, 7:1162 (INIS-mf—6531, pp vp)
**Suwabe, A.,** *See* Takemori, T., 7:588
**Suzuki, H.,** *See* Yagishita, A., 7:1404
**Suzuki, T.,** *See* Shindo, M., 7:681
**Svestka, Z.,** Particle acceleration in the process of eruptive opening and reconnection of magnetic fields, 7:1322
**Sviatoslavsky, I.N.,** *See* Abdel-Khalik, S.I., 7:1685
**Svoboda, N.,** Securing operation safety of liquid sodium test facilities by measurement and control means, 7:549 (INIS-mf—6423, pp vp)
**Svoboda, V.,** Results of study in long-term properties of austenitic steels in liquid sodium, 7:649 (INIS-mf—6423, pp vp)
**Svobodova, M.,** Diagnosis of bone metastases in breast carcinoma by isotope technique with abbreviated recording, 7:1113 (INIS-mf—6421, pp 7)
**Swan, T.,** *See* Stephen, W.J., 7:723
**Sykora, J.,** Coronal responses of the large-scale and long-term phenomena of the lower layers of the Sun, 7:1302
*See* Letfus, V., 7:1296
**Syrovatskii, S.I.,** Physical driving-forces and models of coronal responses, 7:1354
*See* Sermulina, B.J., 7:1360
*See* Sermulinya, B.Ya., 7:1284
*See* Somov, B.V., 7:1359
**Szeless, A.,** *See* Oszuszky, F., 7:616
**Sztanyik, L.B.,** Study on the problems of the radioecology of the river Danube, 7:1038 (IAEA-TECDOC—229, pp 95-126)
**Szydel, N.,** *See* Eilam, Y., 7:1074

## T

**Tabata, Y.,** *See* Okada, S., 7:1436
**Tachibana, T.,** *See* Kaneko, H., 7:505
**Tackenberg, P.,** *See* Harms, J.C., 7:42
**Tadmor, J.,** Occupational radiation protection legislation in Israel, 7:632
Reduction of the environmental concentration of air pollutants by proper geometrical orientation of industrial line sources, 7:981 (IA—1356, pp 280-281)
**Taff, L.M.,** *See* Larwill, M., 7:914
**Taig, A.R.,** Radioactive materials packages and the British railway accident environment, 7:177 (INIS-mf—6447, pp vp)
**Takagi, S.,** *See* Nagakura, T., 7:174
**Takakin, F.,** Kaon-nucleus interactions, 7:1502 (TRI—79-1, pp 82-91)
**Takano, H.,** *See* Nagakura, T., 7:174
**Takase, Y.,** *See* Schuss, J.J., 7:1675
**Takayanagi, T.,** *See* Yagishita, A., 7:1404
**Takeda, H.,** *See* Kaneko, H., 7:220
**Takemori, T.,** Comparison of soil-structure interaction by different ground models, 7:588
**Takeuchi, K.,** *See* Domoto, K., 7:551

**Takikawa, N.,** *See* Nagato, K., 7:599
**Takita, K.,** *See* Kudo, H., 7:1429
**Talas, M.,** *See* Fignerova, H., 7:1109
*See* Fingerova, H., 7:1066
**Tallents, G.J.,** X-ray laser gain measurements in laser produced plasmas, 7:1674 (INIS-mf—6424, pp vp)
**Tam, C.S.,** Measurement of the bone apposition rate by simultaneous labelling of bone formation sites with $^{3}H$ proline and tetracycline, 7:1077
**Tamburrano, A.,** *See* Frittelli, L., 7:570
**Tanabe, J.,** *See* Susukida, H., 7:665
**Tanaka, E.,** *See* Murakami, S., 7:468
**Tanaka, K.,** Energy storage process and energy budget of solar flares, 7:1325
*See* Takemori, T., 7:588
**Tanaka, M.,** *See* Ohashi, N., 7:668
**Tanaka, W.,** *See* Kodaira, K., 7:1370
**Tanaka, Y.,** *See* Clark, S.A., 7:1071
*See* Tsukada, H., 7:666
**Tandon, J.N.,** Coronal structure and solar wind, 7:1300
**Tang, J.H.K.,** *See* Aziz, T.S., 7:392
**Tanzer, F.,** *See* Haeuser, J., 7:1473
**Tao, S.J.,** O-positronium pick-off quenching in dense gases. 1. Theoretical, 7:1431
Positronium formation and thermalization of positrons in dense gases, 7:1433
*See* Tseng, P.K., 7:1432
**Tapping, K.F.,** *See* Gaizauskas, V., 7:1293
**Taragan, E.,** *See* Admon, U., 7:974
**Tarasenko, Yu.I.,** *See* Beletskii, V.I., 7:1108
**Taroni, A.,** *See* Coppi, B., 7:1694
**Tartakovskii, V.K.,** *See* Fursaev, A.V., 7:1571
**Taskaeva, M.I.,** *See* Strezov, A.S., 7:815
**Tatak, V.,** *See* Morcinek, P., 7:396
**Taveras, J.,** *See* Correia, J.A., 7:1087
**Taylor, D.M.,** Speculative uranium resources: their location and magnitude, 7:64
Uranium deposits of the future, 7:97
**Taylor, G.H.,** Symposium. Retrospect and discussion, 7:98
**Taylor, J.C.M.,** Zechstein facies and petroleum prospects in the central and northern North Sea, 7:26
**Taylor, S.R.,** *See* McLennan, S.M., 7:66
**Tazima, T.,** *See* Yoshioka, K., 7:276
**Teasdale, R.W.,** *See* Cort, C.E., 7:1702
**Tedford, C.,** *See* Bradley, F.J., 7:991
**Tegman, R.,** *See* Larker, H.T., 7:207
**Telkes, M.,** Thermal storage in salt-hydrates, 7:268
Thermodynamic basis for selecting heat storage materials, 7:269
**Temme, L.A.,** *See* Fitzgerald, C.R., 7:1172
**Tentner, A.,** *See* Weisman, J., 7:439
**Terent'ev, G.V.,** *See* Sukhorukov, B.Z., 7:1226
**Tereshchenko, L.P.,** *See* Mamotyuk, E.M., 7:1208
**Tereshenko, A.V.,** *See* Mil'ko, V.I., 7:1105
**Tereshenko, L.P.,** *See* Mamotyuk, E.M., 7:1225
**Terry, S.,** *See* Keep, C.W., 7:725, 7:825
**Tesar, O.,** Detection of rock massif stress changes by gamma-gamma logging in Prague underground tunnelling, 7:1268 (INIS-mf—6422, pp vp)
**Tessendorf, T.N.,** Redistributed orebodies of Poison Canyon, Sec. 18 and 19, T. 13 N., R. 9 W., McKinley County, 7:117
**Tewhey, J.D.,** *See* Ringwood, A.E., 7:205
**Theile, B.,** *See* Wilhelm, K., 7:1378
**Theofanous, T.G.,** *See* Sullivan, J.P., 7:904
**Thiele, B.A.,** Determination of end-of-life failure fraction of HTGR-fuel particles by post-irradiation annealing and beta-autoradiography, 7:352
**Thierry, M.,** *See* Alberman, A., 7:289
**Thom, D.,** *See* Barrett, T.R., 7:866
**Thoma, G.,** *See* Sonntag, C., 7:1016
**Thomas, B.J.,** In vivo medical applications of neutrons for diagnosis, 7:1085 (INIS-mf—6531, pp vp)
**Thomas, B.W.,** *See* Thomas, B.J., 7:1085
**Thomasson, R.K.,** BESBET 2 - a computer code for the simulation of severe transients in LMFBR boilers, 7:423
**Thompson, D.T.,** Geophysical experiments at Mariano Lake uranium orebody, 7:140
*See* Lockwood, G.W., 7:1313
**Thompson, R.C.,** Approach to the derivation of radionuclide intake limits for members of the public, 7:1188
**Thompson, R.L.,** *See* Nicovich, J.M., 7:831
**Thomson, J.M.,** *See* Haas, D., 7:500
**Thomson, S.L.,** Hydrodynamic effects in inertial fusion reactors, 7:1688
**Thorpe, G.,** *See* Newbigging, A.W.P., 7:343
**Thorsteinsen, T.F.,** *See* Rekstad, J., 7:1595
**Threlfall, W.F.,** Structural framework of the central and northern North Sea, 7:19
**Thrilling, G.H.,** *See* Scharre, D.L., 7:1489
**Tiegs, T.N.,** *See* Kania, M.J., 7:349
**Tiemens, J.,** *See* Oele, J.A., 7:54
**Tilsley, J.E.,** Continental weathering and development of palaeosurface-related uranium deposits. Some genetic considerations, 7:96
**Timm, U.E.,** Liability and insurance during international transports of nuclear fuel, 7:178 (INIS-mf—6447, pp vp)
**Timofeeva, L.F.,** *See* Akhachinskii, V.V., 7:851
**Timoshin, S.I.,** *See* Afonin, A.A., 7:1622
**Titov, A.I.,** *See* Luk'yanov, V.K., 7:1615
**Titov, Yu.I.,** Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48, pp 80-83)
**Titterton, E.,** Carcinogenic and genetic hazards from environmental, medical and industrial radiation sources, 7:1171 (INIS-mf—6531, pp vp)
**Tiwari, M.D.,** Crystal dynamics and specific heat of copper doped alloys, 7:688
**Tkach, F.S.,** *See* Natarov, V.V., 7:1107
**Tkachenko, G.I.,** *See* Samuleva, S.V., 7:1210
**Tkachenko, V.F.,** *See* Fenkel', L.A., 7:1207
**Tkacheva, G.A.,** *See* Gabuniya, R.I., 7:1101
**Todd, R.G.,** *See* Vail, P.R., 7:30
**Toister, Z.,** *See* Eilam, Y., 7:1074
**Tokiguchi, K.,** *See* Sakudo, N., 7:1387
**Tokimasa, K.,** *See* Asada, Y., 7:664
**Tokubuchi, T.,** Bituminization of low-level liquid waste, 7:208
**Tomczuk, Z.,** Reactions of FeS electrodes in LiCl-KCl electrolyte, 7:608
**Tomes, V.,** *See* Klemensevic, J., 7:397
**Tominaga, S.,** *See* Ireland, D.R., 7:690
**Tomizawa, T.,** *See* Inahara, K., 7:535
**Tomkins, B.,** *See* Johnson, R., 7:660
**Topolcan, O.,** Accuracy and sensitivity of plasma renin activity determination, 7:1054 (INIS-mf—6419, pp vp)
**Torhorst, J.,** *See* del Re Brun, R.M.G., 7:1097
**Torstenfelt, B.,** *See* Allard, B., 7:216
*See* Andersson, K., 7:210
**Tourret, G.,** *See* Marcaillou, J., 7:191
**Tourte, J.,** *See* Briot, F., 7:1186
**Tourwe, H.,** Fast neutron fluence measurements with the Nb-93(n,n')Nb-93m reaction and the application to long-term irradiations, 7:930 (EUR—6813(Vol.2), pp 1245-1252)
*See* De Leeuw, S., 7:444
*See* van Asbroeck, P., 7:291
**Tow, D.,** *See* Schlafer, W. III, 7:592
**Tozer, B.A.,** Holographic post irradiation examination of AGR fuel elements, 7:345
**Trainham, J.A.,** Comparison between flow-through and flow-by porous electrodes for redox energy storage, 7:635
**Trantina, G.G.,** Structural design methods for ceramics in fusion reactors, 7:1701
**Trapp, J.P.,** *See* Carta, M., 7:544
**Tregubov, V.B.,** *See* Selivanov, V.M., 7:453
**Tresise, H.,** Protecting front-line survey and rescue teams during emergencies, 7:569
**Trigger, S.A.,** *See* Klyuchnikov, N.I., 7:1471
**Trilokekar, M.,** *See* Le Goux, J.J., 7:787
**Trimper, S.,** Coupling to a secondary order parameter near the commensurate-incommensurate transition, 7:1648 (INIS-mf—6084, pp vp)
**Tripathi, K.C.,** *See* Sarma, P.R., 7:969
**Tripathi, R.K.,** Nuclear many-body theories, 7:1632
**Tripp, R.N.,** *See* Matthews, J.R., 7:487
**Trocki, L.,** *See* Hansen, M.V., 7:65
**Troshin, S.M.,** *See* Edneral, V.F., 7:1481
**Trott, P.A.,** *See* Husband, J.E., 7:1095
**Troyan, V.I.,** *See* Davydova, L.I., 7:1104
**Tsarikovskaya, N.G.,** *See* Natarov, V.V., 7:1107
**Tschurlovits, M.,** Application of the concept of collective dose commitment in environmental monitoring selection of significant radionuclides, 7:1041 (IAEA-TECDOC—229, pp 35-39)
Considerations on the detection limit in measurements of low level radioactive samples, 7:933 (IAEA-TECDOC—229, pp 23-34)
**Tseng, P.K.,** O-positronium pick-off quenching in dense gases. 2. Experimental results in xenon and carbon dioxide, 7:1432
*See* Tao, S.J., 7:1431
**Tsilyurin, I.T.,** Changes in thrombelastographic indices in patients with thyrotoxicosis treated with radioactive iodine, 7:1242
**Tsuchiya, T.,** *See* Kubota, J., 7:420
**Tsuda, Y.,** *See* Kikutake, T., 7:669
**Tsugawa, T.,** *See* Muto, K., 7:574
**Tsukada, H.,** Static and dynamic fracture toughness behaviour of heavy section

steels for nuclear pressure vessels, 7:666
**Tsukui, K.,** *See* Ohuchi, A., 7:283
**Tsunawaki, Y.,** *See* Iwamoto, N., 7:428
**Tsuruno, A.,** Neutron radiographic techniques in post-irradiation examination, 7:944
**Tsuruta, T.,** Application of solid state track detector to neutron dosimetry, 7:939 (KURRI-TR—190, pp 47-52)
**Tsuruto, C.,** *See* Kitade, K., 7:288
**Tsutsumi, M.,** *See* Imai, Y., 7:1174
**Tsykanov, V.A.,** *See* Samsonov, B.V., 7:541
**Tucker, D.H.,** Characteristics and interpretation of regional gravity, magnetic and radiometric surveys in the Pine Creek Geosyncline, 7:1264
**Tucker, J.S.,** *See* Knezovich, J.P., 7:1247
**Tuempner, J.,** Scanning ion source for static SIMS and depth profiling, 7:950
**Tulak, P.,** *See* Cermak, Z., 7:2
**Tuli, S.K.,** *See* Maurya, A.L., 7:966
**Tully, M.C.,** *See* Donato, J.A., 7:16
**Tumanyan, M.A.,** Prospects of gamma-radiation application in bacteritic vaccine production, 7:1139 (INIS-mf—5673, pp 42-44)
**Turek, K.,** *See* Fulop, M., 7:907
**Turier, C.A.,** *See* Hale, C.W., 7:879
**Turner, F.,** Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369
**Turski, A.J.,** Nonstationary signal transition in linearized plasmas, 7:1475
**Tvergaard, V.,** Structural collapse due to plastic instability, 7:462
**Tyuryukanov, P.M.,** Discharge striking in axially symmetrical electric and magnetic fields, 7:1459
Theory of discharge striking in highly inhomogeneous axially symmetrical magnetic field, 7:1460

## U

**Ubertini, P.,** HXR80M-balloon experiment: a microprocessor-controlled transatlantic payload, 7:948
**Uchida, M.,** *See* Harayama, Y., 7:480
**Uchida, Y.,** Model flare and the continued post-flare mass release from the flare region, 7:1337
**Uerpmann, E.P.,** Technical barriers against a contact of groundwater with disposed radioactive waste, 7:218
**Uglow, A.G.,** Computer data processing systems used in the assessment of Magnox and AGR fuel performance, 7:347
**Ujiie, K.,** *See* Muto, K., 7:574
**Ullmann, V.,** *See* Zavada, M., 7:1053
**Une, K.,** Threshold values characterizing iodine-induced SCC of Zircaloys, 7:494 (IWGFPT—8, pp 226-239)
**Ungrin, J.,** *See* Hepburn, J.D., 7:918
**Unny, V.K.P.,** *See* Vartak, D.G., 7:782
**Unsworth, W.D.,** *See* Haines, C., 7:788
*See* Moyes, H.J., 7:789
**Urakawa, J.,** *See* Sataka, M., 7:1405
**Uskokovic, M.,** *See* Holick, M.F., 7:1173
**Ustimenkov, K.F.,** Program for computation of cross section and analyzing power of deuteron stripping in the analog channel threshold by the distorted wave method, 7:1618 (KFTI—79-40, pp 25-28)
**Uyama, K.,** *See* Hayakawa, S., 7:1369

## V

**Vaelimaa, I.,** *See* Nieminen, R.M., 7:1434
**Vail, P.R.,** Northern North Sea Jurassic unconformities, chronostratigraphy and sea-level changes from seismic stratigraphy, 7:30
**Vais, Yu.I.,** *See* Kudin, A.T., 7:1241
**Vaisfel'd, A.M.,** *See* Gann, V.V., 7:656
**Vaivada, M.A.,** Thermal investigation into formatian of condensed phosphates in the $CeO_2$-$NH_4H_2PO_4$ system, 7:821
**Vakulov, N.V.,** Propagation in the interplanetary space of solar cosmic rays produced in solar flares at longitudes of 46-48 deg in September-November 1973, 7:1278 (INIS-mf—6290, pp 7-8)
**Val'nichek, B.I.,** Development and energy of the solar flare on November 22, 1977, 7:1286 (INIS-mf—6385, pp 160-161)
**Valek, J.,** *See* Kubicek, P., 7:972
**Valente, G.,** Ultimate strength criteria of concrete under bi-axial and tri-axial loading, 7:739
**Valentine, K.H.,** *See* Kania, M.J., 7:349
**van Asbroeck, P.,** Pressure vessel surveillance experience in Belgian power plants, 7:291 (EUR—6813(Vol.1), pp 482-492)
**van Craeynest, J.C.,** *See* Lhermenier, A., 7:864
**Van Dang, K.,** *See* Chaboche, J.L., 7:696
**Van de Velde, J.,** Hot cell installation for biaxial creep and burst testing of cladding specimens, 7:883
*See* van Asbroeck, P., 7:291
**van den Berghe, C.,** *See* de Boodt, M., 7:1122
**van der Sijde, B.,** Collisional radiative model for the argon ion system, 7:899
**Van Essen, D.,** *See* Brasz, J., 7:422
**Van Giai, N.,** *See* Auerbach, N., 7:1580
**van Goethem, G.,** *See* Verbiese, S., 7:580
**Van Hoven, G.,** *See* Chiuderi, C., 7:1335
**van Outryve-D'Ydewalle, Y.,** *See* de Boodt, M., 7:1122
**van Rentergheim, J.,** *See* Biggio, M., 7:1684
**van Tend, W.,** Spicules and macrospicules, 7:1317
**van Voorthuisen, A.E.,** Transaxillary intra-arterial treatment of hepatic metastases with cytostatics and embolization: its control by isotope studies, 7:1177
**Vana, J.,** Modified magnetron discharge facility, 7:1456
**Vance, E.R.,** Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation, 7:718
*See* Davis, D.D., 7:704
*See* Roy, R., 7:206
**Vandersande, J.W.,** *See* Skvarla, M.F., 7:197
**Varaldi, G.,** *See* Guesnier, G., 7:524
**Vartak, D.G.,** Isotopic analysis of water by mass spectrometry, 7:782
Mass spectrometric analysis of gaseous samples, 7:784
**Vassileva, G.J.,** Large-scale magnetic field structure at the Earth's orbit, its correlation with solar activity and orientation and motion of the solar system in the Galaxy, 7:1314
**Vatset, P.I.,** *See* Arkatov, Yu.M., 7:1564
**Vaughan, G.A.,** *See* Hale, C.W., 7:869
**Vazdik, Ya.A.,** *See* Belousov, A.S., 7:1576
**Vejmelka, P.,** *See* Rudolph, G., 7:213
**Veleminsky, J.,** Triiodothyronine RIA using endogenous antibody. Clinical experience, 7:1067 (INIS-mf—6419, pp vp)
**Veltri, P.L.,** *See* Dobrowolny, M., 7:1308
**Veluswami, M.A.,** *See* Horvay, G., 7:598
**Venkat Raj, V.,** *See* Markandeya, S.G., 7:225
**Venkataratnam, P.,** *See* Manjunath, C.V., 7:971
**Venkateswaran, G.,** *See* Venkateswarlu, K.S., 7:278
**Venkateswarlu, K.,** *See* Sethunathan, N., 7:1004
**Venkateswarlu, K.S.,** Pellet-cladding interactions. Detection and location of PCI defects through fission product release during reactor operation/transients and the concept of cumulative PCI damage, 7:278 (IWGFPT—8, pp 41-47)
**Verbiese, S.,** MEL finite element analysis of water-shell interactions in the context of a PWR-LOCA, 7:580
**Verbinski, V.V.,** *See* de Leeuw-Gierts, G., 7:927
**Verdier, J.,** *See* Bon Mardion, G., 7:427
**Veres, K.,** Iodinated steroid derivatives, 7:1056 (INIS-mf—6419, pp vp)
**Verier, K.M.,** *See* Sen, P., 7:777
**Verma, P.C.,** *See* Bhat, I.S., 7:1047
**Vertut, J.,** Advanced manipulator system for large hot cells, 7:867
**Veysseyre, H.,** *See* Absi, E., 7:571
**Vialettes, H.,** Advantages presented by the industrial introduction of information processing in the centralised surveillance of radiation levels, 7:623
**Videm, K.,** *See* Lunde, L., 7:492, 7:653
**Vignaud, J.C.,** Replacement of hard coating in nuclear values: results of testing of cobalt free valves, 7:457
**Vignesoult, N.,** In-cell refabrication of experimental fuel rods using rods pre-irradiated in a power reactor, 7:507
*See* Pineira, T., 7:511
**Viktorov, A.P.,** Activity of $^{32}P$ inclusion and content of adenylic system components in myocardium of growing rats at $\beta$-adrenergetic block, 7:1082
Activity of $^{32}P3$ inclusion and glycogen content in rat myocardium following alpha-adrenergic blockade, 7:1120
**Villoresi, G.,** *See* Iucci, N., 7:1350
**Vilpponen, K.O.,** In-pile measurements of pellet cladding interaction and relaxation, 7:474 (IWGFPT—7, pp 96-102)
*See* Seppae, E.K., 7:554
**Violet, J.L.,** *See* Bon Mardion, G., 7:427
**Visser, J.H.,** *See* Salem, O., 7:1021
**Vit'ko, V.I.,** *See* Bochek, G.L., 7:1640
**Vivien, I.F.,** *See* Beck, F., 7:1592

**Vivien, M.,** *See* Geffroy, J., 7:406
**Vladimirova, A.F.,** Study on after-actions of transient damages of cerebral circulation in patients with erythremia by the radiocirculography method, 7:1106
**Vogel, H.J.,** Opening lecture, 7:1710
**Vogl, W.,** Experimental strategy of fuel performance testing with respect to PCI, 7:498 (IWGFPT—8, pp 34-40)
**Vogt, E.,** *See* Francke, K.P., 7:508
**Vogt, K.J.,** *See* Brenk, H.D., 7:990
**Vogt, S.,** *See* Huebschmann, W.G., 7:567
**Voigt, K.,** *See* Stoeter, P., 7:1094
**Vokhmin, P.A.,** *See* Klimovski, I.I., 7:892
**Volkov, L.A.,** *See* Tsilyurin, I.T., 7:1242
**Volkova, A.A.,** *See* Romas', R.S., 7:1116
**Volland, H.,** *See* Bird, M.K., 7:1357
*See* Porsche, H., 7:1365
**Vollrath, K.,** *See* Hirth, A., 7:889
**Vologdin, N.I.,** *See* Vakulov, N.V., 7:1278
**Voloshchuk, V.I.,** *See* Arkatov, Yu.M., 7:1564
**von Harrach, D.,** Fission properties of very heavy nuclei produced in deep-inelastic collisions, 7:1603
**von Jan, R.,** Experience and plans with PCI protection in KWU LWR plants, 7:502 (IWGFPT—8, pp 78-85)
*See* Vogl, W., 7:498
**Vorontsov, S.S.,** Influence of fluid-dynamic phenomena on the transverse electrical glow discharge, 7:1443
**Vorontsov-Veliaminov, P.N.,** Computer simulation of equilibrium and kinetic properties of ionic and plasma clusters, 7:1474
**Voshall, R.E.,** *See* Emtage, P.R., 7:1453
**Voto, R.H. de,** Geology of uranium vein deposits (including Schwartzwalder Mine) in Proterozoic metamorphic rocks, Front Range, Colorado, 7:93
**Vowels, M.R.,** Total body irradiation on bone marrow transplantation, 7:1084 (INIS-mf—6531, pp vp)
**Vuletich, T.,** *See* Derenzo, S.E., 7:1086
**Vusik, I.M.,** Child-bearing function in women with ionizing radiation, 7:1213
*See* Kogan, I.A., 7:1231

## W

**Waas, G.,** Soil structure interaction analysis by different methods, 7:589
**Waddington, J.S.,** *See* Hines, G.F., 7:344
**Wagh, A.G.,** Channeling in thin lead sulphide films, 7:1644
*See* Gaonkar, S.G., 7:1639
**Wagner, G.H.,** Dynamic aspects of soil organic matter and its relationship to the physical properties and fertility of soils, 7:1123 (IAEA-TECDOC—236, pp 66-74)
**Waite, R.J.,** *See* Keep, C.W., 7:725
**Wakiya, K.,** *See* Yagishita, A., 7:1404
**Walder, V.,** *See* Dufek, F., 7:398
*See* Mohyla, F., 7:651
*See* Morcinek, P., 7:396
**Walker, D.C.,** Origins of optical activity in nature, 7:740
**Walker, R.S.,** Roessing, a case history of economic and social benefits from uranium mining, 7:618
**Walker, R.W.,** *See* Collier, D., 7:533
**Wallace, J.N.,** Design concepts and experience in the application of distributed computing to the control of large CEGB power plant, 7:274 (AECL—7056, pp 198-213)
**Walluschek, W.,** *See* Schwiers, H.G., 7:373
**Walther, R.,** Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.3. Experimental studies on the behaviour of concrete and liner at high temperature, 7:335 (IWGHTR—2, pp 44-50)
**Walton, N.R.G.,** *See* Edmunds, W.M., 7:1014
**Walton, R.J.,** Investigation of a bolted coal mine roof during mining at Nattai North Colliery, 7:9
**Wang, S.R.,** Fuel element and materials hot laboratory in Beijing, 7:881
**Ward, A.,** 'Intelligent' radiation instruments, 7:954
**Warnecke, E.,** Evaluation of product specifications with a safety analysis for a disposal mine, 7:194
**Warner, F.,** Risk and response, 7:614
**Warner, R.K.,** *See* Bath, L.J., 7:154
**Warren, D.,** *See* Bradley, F.J., 7:991
**Washimi, H.,** Observations of interplanetary scintillation and a theory of high-speed solar wind, 7:1362
**Watanabe, H.,** Balloon observation of galactic gamma-ray lines, 7:1368
**Watanabe, R.,** *See* Hirano, T., 7:684
*See* Noda, T., 7:820
**Watanabe, T.,** Dynamical effect on the ionization processes in ion-atom collisions, 7:1408
IPS observations of flare-generated disturbances, 7:1353
*See* Kodaira, K., 7:1370
**Waterman, M.S.,** *See* Smith, T.F., 7:1069
**Wathne, E.,** *See* Heritier, F.E., 7:55
**Watkin, J.S.,** Effect of small fourth-element alloying additions on the calculated phase stability in the Fe-Cr-Ni system, 7:672
*See* Miodownik, A.P., 7:673
**Watkins, M.L.,** Considerations on the approach to ignition in large tokamaks, 7:1677
**Watts, A.J.,** Automatic data collection in PIE, 7:340
**Wawersik, J.,** *See* Ruegheimer, E., 7:1203
**Way, M.,** *See* Wise, J., 7:1487
**Weaver, J.,** *See* Huddleston, A.L., 7:1098
**Webb, C.E.,** *See* Buyck, W.J., 7:675
**Webb, D.F.,** X-ray evidence of coronal preflare emission, 7:1316
**Webb, J.R.,** Protection from common-mode events, 7:604
**Weber, F.,** *See* Gauthier-Lafaye, F., 7:91
**Weber, W.,** *See* Waas, G., 7:589
**Webster, J.M.,** *See* Tozer, B.A., 7:345
**Wedell, R.,** Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449, pp vp)
**Weibel, P.A.,** New automated mass spectrometer for high precision isotope ratio determinations of gases, 7:785
New computerized mass spectrometer for isotopic analyses of solids, 7:786
**Weise, H.P.,** *See* Heumos, K., 7:860
**Weisman, J.,** Application of the method of characteristics to solution of nuclear engineering problems, 7:439
**Weisner, R.H.,** Enterohepatic physiology of 1,25-dihydroxyvitamin D in normal man, 7:1073
**Weiss, W.,** Tritium and helium-3 studies in Lake Constance, 7:1030
**Welker, D.L.,** Genetic characterisation of radiation-sensitive mutations of the slime mould Dictyostelium discoideum, 7:1154 (INIS-mf—6531, pp vp)
**Wellein, R.,** *See* Schmitt, W., 7:311, 7:331
**Weng, P.S.,** *See* Mei, T.Y.C., 7:994
**Wentworth, D.W.,** Geology of Crownpoint Sec. 29 uranium deposit, McKinley County, 7:109
**Werme, L.O.,** *See* Nyholm, R., 7:200
**Wervers, H.J.,** *See* Dassel, G., 7:873
**Wester, H.J.,** *See* Lethert, E.K., 7:375
**Westerman, M.,** Induction of DNA polymerase activity in irradiated Chinese Hamster cells, 7:1150 (INIS-mf—6531, pp vp)
*See* Sutherland, M.W., 7:1162
**Westerman, R.E.,** Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**Westermark, T.,** *See* Forberg, S., 7:209
**Westrum, E.F. Jr.,** Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
*See* Cordfunke, E.H.P., 7:848
**Whineray, S.,** *See* Thomas, B.J., 7:1085
**White, A.R.,** Why rising cross-sections are further evidence for a non-Abelian gauge theory of strong interactions, 7:1521
**White, F.,** Scientific advances and community risk. Proceedings of a meeting of the Science and Industry Forum of the Australian Academy of Science, held on October 6-7, 1978, 7:235
**White, L.J.,** *See* Peagram, G.W., 7:870
**White, P.C.,** Fossil energy research and development in ERDA, 7:633
**White, P.R.,** Solar tracking system, 7:259 (NASA-CASE-MFS—23999-1)
**White, W.B.,** *See* Komarneni, S., 7:705
*See* Roy, R., 7:206
**Whitley, P.K.J.,** *See* Parry, C.C., 7:29
*See* Simpson, R.D.H., 7:37
**Whitlock, G.D.,** Tritium - is it underestimated, 7:961
**Whitlow, W.H.,** *See* Coquerelle, M., 7:875
**Whitten, J.,** *See* McKercher, H.G., 7:1079
**Wicke, A.,** *See* Kiefer, J., 7:1049
**Wickham, A.J.,** Behaviour of hydrogenous compounds in reactor coolants, 7:366
**Wiederhold, G.,** *See* Donnerhacke, K.H., 7:890
**Wiffen, F.W.,** *See* Cox, B.L., 7:680
**Wilhelm, J.,** *See* Winkler, R., 7:1466, 7:1468
**Wilhelm, K.,** Sounding rocket observations of field-aligned current sheets, 7:1378 (ESA-SP—152, pp 279-284)
**Wilhelm, R.,** Microprocessor based area monitor system for neutron and gamma radiation, 7:921
**Wilhelmy, J.B.,** *See* von Harrach, D., 7:1603
**Wilk, G.,** *See* Rek, Z.J., 7:1549
**Wilkinson, J.P.D.,** *See* Trantina, G.G., 7:1701
**Willaschek, J.,** 3-D inelastic analysis of HTR graphite structures and a

comparison with A 2-D approach, 7:432
**Williams, B.J.,** *See* Schreiber, H.D., 7:201
**Williams, C.,** *See* Hoffman, E.J., 7:1118
**Williams, D.L.H.,** Aromatic cationic rearrangements. Chapter 4, 7:828
**Williams, K.L.,** *See* Philip, G.M., 7:124
**Williams, W.J.,** *See* Norfolk, D.J., 7:839
*See* Skinner, R.F., 7:365
**Willis, W.O.,** Water conservation in semiarid dryland agriculture, 7:1130 (IAEA-TECDOC—236, pp 10-25)
**Wills, K.,** *See* Stuart-Smith, P.G., 7:1251
**Wilmshurst, J.R.,** *See* Binns, R.A., 7:79
**Wilson, A.F.,** *See* Bakshi, A.K., 7:1275
**Wilson, H.W.,** Development and correlation of cladding creep and irradiation growth models, 7:476 (IWGFPT—7, pp 108-117)
**Wilson, W.K.,** *See* Dowling, N.E., 7:699
**Winchester, J.W.,** Applications of trace element analysis to studies of the atmospheric environment. Chapter 5. Section 3, 7:757
**Winer, P.,** *See* Ferguson, J., 7:67
**Winkler, P.,** *See* Dufek, F., 7:398
**Winkler, R.,** Collision dominated electron distribution function with turbulent heating in the $H_2$ plasma, 7:1466
Collision dominated final periodic state of the electron ensemble and its adjustment in a periodic electric field, 7:1468
**Winter, R.,** Subcellular distribution of $^{239}$Pu in the liver of rat, mouse, Syrian and Chinese hamster, 7:1183
**Wise, J.,** Precise measurement of the ratio of the axial vector coupling to vector coupling in $A^0 \rightarrow p + e^- +$ anti $\nu$, 7:1487
**Witt, A.,** *See* Hinterleitner, H., 7:446
**Woerlee, P.H.,** *See* Watanabe, T., 7:1408
**Wolfer, W.G.,** *See* Odette, G.R., 7:1696
**Wolgemuth, G.A.,** *See* Ko, P.L., 7:442
**Wong, C.,** *See* Murray, D.W., 7:387
**Wong, C.W.,** *See* Liu, K.F., 7:1501
**Wong, K.M.,** Differences in response of serum calcium, $^{45}$calcium, and $^{3}$H-tetracycline to parathyroid hormone in normal and calcium-deficient dogs, 7:1080
**Wood, M.H.,** *See* Matthews, J.R., 7:471
**Woodruff, W.L.,** RERTR/ANL-KURRI results and comparison on reduced enrichment for the KUHFR, 7:542 (KURRI-TR—192, pp 12-17)
**Woody, C.L.,** *See* Stroynowski, R., 7:1488
**Woolcock, W.S.,** Meson exchange and the photodisintegration of the deuteron, 7:1567
**Woolfrey, J.L.,** *See* Buyck, W.J., 7:675
*See* Reeve, K.D., 7:708
**Wright, R.J.,** Grants and world uranium, 7:100
**Wright Harmon, D.,** Archipelago of nuclear material export licensing, 7:612 (INIS-mf—6447, pp vp)
**Wu, C.H.,** *See* Ihle, H.R., 7:1680
**Wu, G.F.,** *See* Mei, T.Y.C., 7:994
**Wu, S.T.,** Theoretical interpretation of traveling interplanetary phenomena and their solar origins, 7:1355
*See* Nakagawa, Y., 7:1361
*See* Steinolfson, R.S., 7:1358
**Wuebber, B.R.,** *See* Stansfield, J.M., 7:985
**Wuerdemann, G.,** *See* Hartwig, S., 7:176
**Wullaert, R.A.,** Status of radiation embrittlement trend curve data base re-evaluation, 7:292 (EUR—6813(Vol.1), pp 501-509)
**Wyatt, A.,** Inquiries into nuclear energy, 7:624

## Y

**Yadav, J.S.,** Sensitivity enhancement of glass detectors, 7:967
*See* Gomber, K.L., 7:965
*See* Singh, V.P., 7:964
**Yadav, V.S.,** *See* Bhide, V.G., 7:1660
**Yagawa, G.,** *See* Masuda, M., 7:1698
**Yagi, T.,** *See* Tokubuchi, T., 7:208
**Yagisawa, H.,** *See* Namiki, M., 7:1424
**Yagishita, A.,** Spectral shapes of the molecular autoionization caused by $Li^+ + He$ collisions at energies lower than 1.1 keV, 7:1404
*See* Nakai, Y., 7:1417
**Yakovenko, M.G.,** *See* Shantyr', V.I., 7:1211
**Yamada, J.,** Experiment on development of high pressure laser plasma and absorption of laser, 7:1478
**Yamashita, H.,** *See* Hayakawa, S., 7:1366
**Yamauchi, M.,** *See* Ohtani, N., 7:416
**Yamnitskii, V.A.,** *See* Gann, V.V., 7:656
**Yan, G.,** *See* Capel, A.C., 7:531
**Yanagimachi, T.,** *See* Doke, T., 7:962
**Yankelevitch, E.B.,** *See* Litvinov, E.A., 7:1445
**Yartsev, Yu.V.,** *See* Bronin, S.Ya., 7:1462
**Yasinova, A.A.,** Autosensibilization of organism in different pathologic states and radiotherapy of oncologic patients, 7:1220
**Yeh, T.,** Global modeling of disturbances in the corona-interplanetary space, 7:1363
**Yellin, E.,** Forensic applications. Chapter 5. Section 6, 7:760
**Yongue, W.H. Jr.,** *See* Cairns, J. Jr., 7:1114
**Yoon, K.K.,** *See* Murty, K.L., 7:522
*See* Wilson, H.W., 7:476
**Yoshida, H.,** *See* Hirano, T., 7:684
*See* Noda, T., 7:820
**Yoshimori, M.,** *See* Watanabe, H., 7:1368
**Yoshimoto, T.,** Rare gas especially $^{41}$Ar released from research nuclear reactor and its in-situ measurement, (2), 7:988 (KURRI-TR—179, pp 23-27)
**Yoshioka, K.,** Condensate clean up control system with distributed DDC, 7:276 (AECL—7056, pp 180-191)
*See* Inahara, K., 7:535
**Young, D.G.G.,** *See* Robinson, K.W., 7:50
**Young, P.,** Mining and the natural environment: water and the dispersion of pollutants, 7:230
**Young, R.,** *See* Barr, K.W., 7:49
*See* Carman, G.J., 7:44
**Ypma, P.J.M.,** Fluid inclusion and oxygen isotope studies of the Nabarlek and Jabiluka uranium deposits, Northern Territory, Australia, 7:76
**Yudin, O.V.,** *See* Gann, V.V., 7:1641
**Yukhimuk, A.K.,** *See* Dorman, L.I., 7:1281
**Yule, H.P.,** Manual and computerized data processing in activation analysis. Chapter 4, 7:754
Tables of gamma-ray peaks observed in reactor neutron activation analysis. Appendix. Chapter 6, 7:761
**Yung-Shih Chen,** *See* Hoch, M., 7:166
**Yushchenko, L.P.,** *See* Mel'nikova, S.M., 7:1215
**Yuuki, R.,** *See* Asada, Y., 7:664

## Z

**Zabrodskii, Yu.R.,** *See* Koshkin, V.M., 7:1651
**Zaduban, M.,** Complex use of nuclear energy resources in Czechoslovakia, 7:1135 (INIS-mf—6420, pp vp)
**Zagryazkin, V.N.,** Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide, 7:852
**Zainel, H.A.,** *See* Westrum, E.F. Jr., 7:849
**Zaitsev, V.T.,** *See* Davydova, L.I., 7:1104
**Zajdman, V.E.,** *See* Marega, I.N., 7:1100
**Zakharchenko, V.F.,** *See* Belyaev, V.A., 7:1279
**Zalyubovskii, I.I.,** *See* Ustimenkov, K.F., 7:1618
**Zalyubovskij, I.I.,** *See* Dejneko, A.S., 7:935
**Zamorani, E.,** Design of fuel pins containing by-product actinides for irradiation in LWR and FBR power plants, 7:187 (EUR—6929, pp 293-330)
*See* Facchini, A.G., 7:163
**Zarka, J.,** Inelastic analysis of structures with applications to cyclic loadings, 7:464
**Zavada, M.,** Prerequisites and possibilities of small computer processing of RIA results, 7:1053 (INIS-mf—6419, pp vp)
*See* Safarcik, K., 7:1110
*See* Topolcan, O., 7:1054
**Zdenek, K.,** Chemical inhomogeneity of large forging ingots, 7:454
**Zecevic, V.,** Framatome's multiple examination device and on-site removable fuel rods examination stand, 7:877
**Zehlein, H.,** *See* Erb, J., 7:1690
**Zeisser, P.,** *See* Cords, H., 7:737
**Zelenkov, A.G.,** New measurements of partial decay half-lives of the isomeric state of /sup 242m/Am, 7:1598 (INDC(CCP)—135/LN, pp 25-26)
*See* Zhudov, V.I., 7:1600
**Zeller, E.J.,** Evaluation of uranium resources in Antarctica, 7:127
**Zeller, M.V.,** *See* Phillips, B.F., 7:1428
**Zemtsov, Yu.K.,** *See* Rodin, A.V., 7:893
**Zenevich, V.A.,** Evaluation of the characteristics of secondary neutrons and gamma rays in the interaction between neutrons and the $^{242}$Pu nucleus, 7:1602 (INDC(CCP)—150/LJH, pp 92-109)
**Zesenko, A.Ya.,** *See* Gusev, D.I., 7:1039
**Zetterberg, H.I.,** Swedish nuclear referendum 1980, 7:615
**Zetzsche, A.,** *See* Ross, R., 7:713
**Zharikov, V.N.,** *See* Demirkhanov, R.A., 7:1461
**Zhebrovskii, Yu.V.,** *See* Bochek, G.L., 7:1640
**Zhidovtseva, M.I.,** Immediate and delayed radiation reaction of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1216

State of motor function of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1240
**Zhudov, V.I.,** Conversion electron spectrum of the $(1/2)^+$ isomer of $^{235}U$, 7:1600 (INDC(CCP)—135/LN, pp 35-41)
Half-life of the $(1/2)^+$-isomer of $^{235}U$, 7:1599 (INDC(CCP)—135/LN, pp 27-33)
**Zhukov, V.M.,** *See* Aksenov, M.S., 7:1444
**Zhut'ko, A.A.,** Experiment on radiotherapy of postnatal mastitis, 7:1237
*See* Beletskii, V.I., 7:1238
**Ziegler, P.A.,** Evolution of sedimentary basins in northwest Europe, 7:14
**Zieminski, A.,** $\pi^-\pi^-$ scattering at high energies, 7:1498
**Ziemsen, K.,** Technical standards and quality assurance, 7:1714
**Zijp, W.L.,** Comparison of four neutron spectrum unfolding codes, 7:438 (EUR—6813(Vol.2), pp 787-806)
**Zimackova, M.,** *See* Mucha, J., 7:1060
**Zimmermann, U.,** Determination by stable isotopes of underground inflow and outflow and evaporation of young artificial groundwater lakes, 7:1027
**Zindler, M.,** *See* Ruegheimer, E., 7:1203
**Zoetl, J.G.,** *See* Hoetzl, H., 7:1025
**Zolenko, V.A.,** *See* Arkatov, Yu.M., 7:1564
**Zsdanszky, K.,** *See* Duftschmid, K.E., 7:952
**Zuppi, G.M.,** *See* Fontes, J.C., 7:1026
**Zytchenko, L.N.,** *See* Shapiro, A.L., 7:1451

# SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms. Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

**SUBJECT DESCRIPTOR**
**Qualifier**
Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

## A


**A-1 REACTOR (CALDER HALL)**
*See CALDER HALL A-1 REACTOR*

**A-2 REACTOR (CALDER HALL)**
*See CALDER HALL A-2 REACTOR*

**ABDOMEN**
**Computerized Tomography**
CT guided percutaneous fine needle aspiration of intra-abdominal and pelvic masses, 7:1095

**ACCELERATORS**
*See also CERN SPS SYNCHROTRON*
*DUBNA SYNCHROCYCLOTRON*
*ELECTROSTATIC ACCELERATORS*
*FERMILAB ACCELERATOR*
*HEAVY ION ACCELERATORS*
*TANDEM ELECTROSTATIC ACCELERATORS*
*VAN DE GRAAFF ACCELERATORS*
**Beam Focusing Magnets**
Electrostatic scanning of a few mA ion beam. Application to an ion implanter, 7:912
**Beam Monitoring**
Beam current measuring, 7:922
**Beam Monitors**
Beam detection and dose measurement, 7:917
**Beam Optics**
Electrostatic scanning of a few mA ion beam. Application to an ion implanter, 7:912
**Beam Transport**
Beam transport for ion implantation, 7:910
Low-energy ion beam transport by permanent magnets, 7:911
**Neutral Atom Beam Injection**
Spark-resistant design for high-voltage high-current accelerating columns, 7:918

**ACCIDENTS**
*See also FUEL ELEMENT FAILURE*
*LOSS OF COOLANT*
*MELTDOWN*
*RADIATION ACCIDENTS*
*REACTOR ACCIDENTS*
*TRANSIENT OVERPOWER ACCIDENTS*
**Emergency Plans**
Protecting front-line survey and rescue teams during emergencies, 7:569

**ACES**
*See QUARKS*

**ACETABULARIA**
**Radiobiology**
Radiobiological and radioecological studies with the unicellular marine algae Acetabularia, Batophora and Dunaliella, 7:1192
**Radioecology**
Radiobiological and radioecological studies with the unicellular marine algae Acetabularia, Batophora and Dunaliella, 7:1192

**ACID CARBONATES**
**Sorption**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216

**ACTINIDE COMPLEXES**
**Thermodynamic Properties**
Aqueous actinide complexes. A thermochemical assessment, 7:847

**ACTINIDE NUCLEI**
**Decay**
Measurements and evaluations of nuclear data on actinide isotopes. Review of papers published by Soviet scientists during 1975-1978, 7:1597 (INDC(CCP)—135/LN)
**Neutron Reactions**
Fission barrier theory and its application to the calculation of actinide neutron cross-sections, 7:1614 (IAEA-SMR—43)

**ACTINIDES**
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**Recycling**
Recycling of actinides in light water reactors, 7:431
**Transmutation**
Design of fuel pins containing by-product actinides for irradiation in LWR and FBR power plants, 7:187 (EUR—6929)

**ACTIVATION ANALYSIS**
**Calibration Standards**
High purity materials, standards, and reference materials. Chapter 5. Section 4, 7:758
**Counting Techniques**
Neutron counting in activation analysis. Chapter 3. Section 3, 7:750
**Data Processing**
Manual and computerized data processing in activation analysis. Chapter 4, 7:754
**Gamma Spectra**
Tables of gamma-ray peaks observed in reactor neutron activation analysis. Appendix. Chapter 6, 7:761
**Uses**
Applications to archaeology. Chapter 5. Section 5, 7:759
Biomedical sciences. Chapter 5. Section 1, 7:755
Geo- and cosmochemistry. Chapter 5. Section 2, 7:756

**ACTIVATION DETECTORS**
**Benchmarks**
Dosimetry characterization of a reactor pressure vessel simulator by fission chamber and foil activation measurements, 7:926 (EUR—6813(Vol.2))
**Neutron Dosimetry**
Dosimetry characterization of a reactor pressure vessel simulator by fission chamber and foil activation measurements, 7:926 (EUR—6813(Vol.2))

Fast neutron fluence measurements with the Nb-93(n,n')Nb-93m reaction and the application to long-term irradiations, 7:930 (EUR—6813(Vol.2))
Multialgorithm unfolding studies of neutron spectra from activation detectors, 7:437 (EUR—6813(Vol.2))

**ADENOCARCINOMAS**
*See CARCINOMAS*

**ADENOSINE MONOPHOSPHATE**
*See AMP*

**ADRENAL GLANDS**
**Biological Radiation Effects**
Functional state of adrenal glands of patients with endometrium cancer before and after radiotherapy, 7:1217

**ADVANCED GAS COOLED GRAPHITE REACTOR**
*See AGR TYPE REACTORS*

**ADVANCED THERMAL REACTOR FUGEN**
*See JATR REACTOR*

**AERE**
*(Atomic Energy Research Establishment.)*
**Hot Cells**
Recent developments in post-irradiation examination techniques at Harwell, 7:878

**AEROSOLS**
**Activation Analysis**
Applications of trace element analysis to studies of the atmospheric environment. Chapter 5. Section 3, 7:757

**AFRICA**
*See also EGYPTIAN ARAB REPUBLIC*
*GABON*
*KENYA*
*LIBYA*
*NIGER*
*SUDAN*
*TUNISIA*
**Ground Water**
Environmental isotope study of groundwater systems in the Republic of Djibouti, 7:1026

**AGR REACTOR (WINDSCALE)**
*See WAGR REACTOR*

**AGR TYPE REACTORS**
*See also HINKLEY POINT-B REACTOR*
*HUNTERSTON-B REACTOR*
*WAGR REACTOR*
**Coolants**
Carbon formation processes relevant to advanced carbon dioxide-cooled reactors, 7:357
Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839
Methanation of carbon dioxide over a ruthenium catalyst for AGR gas circuit composition control, 7:248
Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
Trace organics in AGR coolants, 7:367
**Corrosion Inhibitors**
Behaviour of hydrogenous compounds in reactor coolants, 7:366
**Fuel Assemblies**
Instrument to measure the wear scars formed on the tie bar of the CAGR fuel assembly, 7:354
**Fuel Element Failure**
Detection and location of leaks in irradiated CAGR fuel, 7:350
**Fuel Pins**
Measurement and analysis of stress rupture tests on CAGR cladding tubes, 7:164
**Moderators**
Calculation of methane profiles in graphite structures, 7:722
Graphite oxidation experiment to high weight loss under CAGR conditions, 7:362
Implications of radiolytic graphite corrosion on AGR brick integrity, 7:364
Modelling of AGR radiolytic graphite corrosion, 7:363
Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
**Nuclear Fuels**
Computer data processing systems used in the assessment of Magnox and AGR fuel performance, 7:347
**Spent Fuel Elements**
Automatic data collection in PIE, 7:340
Further developments in the non-destructive examination of irradiated fuel rods at Windscale, 7:512
Holographic post irradiation examination of AGR fuel elements, 7:345
Review of non-destructive testing techniques employed by the CEGB for the post-irradiation examination of Magnox and CAGR fuel, 7:346
**Spent Fuels**
Objectives and organisation of a national post-irradiation examination programme for commercial advanced gas-cooled reactor fuel, 7:344
Post-irradiation examination techniques for CAGR fuel, 7:353

**AGRICULTURE**
Water conservation in semiarid dryland agriculture, 7:1130 (IAEA-TECDOC—236)
**Irrigation**
Mission of the central commission of the Czechoslovak Academy of Agriculture for use of energy resources and nuclear methods in agriculture, 7:1133 (INIS-mf—6420)
**Resource Conservation**
Some aspects in relation to the efficient use of soils, water and fertilizers in Egypt, 7:1126 (IAEA-TECDOC—236)
**Tracer Techniques**
Soil erosion, fertility and water conservation factors in agricultural activities in Kenya: A look at problems and efforts being made to solve them using radioisotope techniques, 7:1128 (IAEA-TECDOC—236)
**Waste Heat Utilization**
Complex use of nuclear energy resources in Czechoslovakia, 7:1135 (INIS-mf—6420)
Mission of the central commission of the Czechoslovak Academy of Agriculture for use of energy resources and nuclear methods in agriculture, 7:1133 (INIS-mf—6420)
Use of nuclear heat for a food and agricultural complex. Conclusions of model solution for reference locality of WWER type power plants in Czechoslovakia, 7:1134 (INIS-mf—6420)

**AIR POLLUTION**
**Stack Disposal**
Reduction of the environmental concentration of air pollutants by proper geometrical orientation of industrial line sources, 7:981 (IA—1356)

**AIR POLLUTION CONTROL**
**Economic Impact**
Bubble concept: an examination of two applications in the utility industry, 7:1000

**ALARM DOSEMETERS**
*See RADIATION MONITORS*

**ALARM SYSTEMS**
**Control Systems**
Securing operation safety of liquid sodium test facilities by measurement and control means, 7:549 (INIS-mf—6423)

**ALBUMINS**
**Homeostasis**
Role of bone in calcium ion homeostasis: studies with indicator-dilution methods, 7:1078

**ALCATOR DEVICE**
**Heating**
Lower hybrid heating in the Alcator A tokamak, 7:1675

**ALFVEN WAVES**
**Parametric Instabilities**
Parametric amplification of Alfven waves, 7:1672 (INIS-mf—6424)
**Reflection**
Reflexion and transmission of Alfven waves in an atmosphere, 7:1305

**ALGAE**
*See also ACETABULARIA*
**Radiobiology**
Radiobiological and radioecological studies with the unicellular marine algae Acetabularia, Batophora and Dunaliella, 7:1192
**Radioecology**
Radiobiological and radioecological studies with the unicellular marine algae Acetabularia, Batophora and Dunaliella, 7:1192

**ALKALI METAL COMPOUNDS**
**Excited States**
Photoexcited states of organic anions, 7:834

**Photochemistry**
Photoexcited states of organic anions, 7:834
**ALKALI METALS**
*See also CESIUM*
*LITHIUM*
*POTASSIUM*
*RUBIDIUM*
*SODIUM*
**Crystal Models**
Unified study of static and dynamic properties of alkali metals, 7:687
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**Population Inversion**
Inversion of the atomic level population densities in low temperature alkali plasma, 7:897
**ALKALINE EARTH METALS**
*See also BARIUM*
*BERYLLIUM*
*CALCIUM*
*MAGNESIUM*
*RADIUM*
*STRONTIUM*
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**ALLOY 800**
*See INCOLOY 800*
**ALLOY-HD-8077**
*See NICKEL BASE ALLOYS*
**ALLOY-MA-754**
*See NICKEL BASE ALLOYS*
**ALLOYS**
**Creep**
Creep ratcheting bounds based on elastic core concept, 7:695
**Deformation**
History dependence of stress-strain diagrams and creep curves under variable repeated loading, 7:692
**Plasticity**
Damage postulate for nonproportional cyclic plasticity, 7:694
**ALLOY-TZM**
**Physical Radiation Effects**
The ductility in bending of molybdenum alloys irradiated between 425 and 1000 C, 7:680
**ALLOY-WAZ-16**
*See NICKEL BASE ALLOYS*
**ALLUVIAL DEPOSITS**
**New Mexico**
Deposition and early hydrologic evolution of Westwater Canyon wet alluvial-fan system, 7:102
**ALPHA REACTIONS**
**Inelastic Scattering**
Problem of monopole resonance in nuclei, 7:1623 (KFTI—79-48)
**ALPHA SPECTRA**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**ALPHA SPECTROMETERS**
**Energy Resolution**
Low-energy α-particle spectrometer for elastic scattering studies, 7:935 (KFTI—79-40)
**Specifications**
Low-energy α-particle spectrometer for elastic scattering studies, 7:935 (KFTI—79-40)
**ALPHA-BEARING WASTES**
**Radiation Monitoring**
Passive γ-ray monitoring of plutonium contaminated waste, 7:237 (EUR—6813(Vol.2))
**ALUMINATES**
**Chemical Reactions**
Precipitation of radiostrontium in soil, 7:1008
**ALUMINIUM**
**Absorption Spectroscopy**
Stable product low leach glasses, 7:202
**Activation Analysis**
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**Bremsstrahlung**
Internal and external bremsstrahlung spectra in thick lead and aluminium targets excited by soft beta rays, 7:1643
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Internal Bremsstrahlung**
Internal and external bremsstrahlung spectra in thick lead and aluminium targets excited by soft beta rays, 7:1643
**Ion Collisions**
Electron capture and loss to, or from wake-riding states by fast ions in metals, 7:1418
Inner shell ionization in the collision system of $Z_1 << Z_2$, 7:1401
K, L and M shell ionizations in the energy region E/lambda U > 1, 7:1400
**Leaching**
Stable product low leach glasses, 7:202
**Physical Radiation Effects**
Device for the low-temperature electron irradiation, 7:247 (KFTI—79-65)
**Spectrophotometry**
Analysis of uranium and some uranium alloys. Aluminium spectrophotometric determination, 7:793 (CEA-CETAMA—7)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**ALUMINIUM 27 TARGET**
**Photonuclear Reactions**
Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV, 7:1576 (KFTI—80-6)
**ALUMINIUM ALLOYS**
**Crystal-Phase Transformations**
Sequence of phase transformations in the Zr-14AT%AL alloy, 7:643
**Phase Stability**
Thermodynamic instability of a solid solution of aluminium in plutonium (delta-phase) at room temperature, 7:851
**Stress Analysis**
Yielding of 6061-T6 aluminium tubings under dynamic biaxial loadings, 7:697
**ALUMINIUM COMPOUNDS**
**Nuclear Magnetic Resonance**
Influence or preparation methods on structural integrity of Na-A and Na-α zeolites and on occlusion of aluminum compounds studied by H-NMR of sorbed water and ammonia, 7:730
**ALUMINIUM SILICATES**
**Redox Reactions**
Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses, 7:201
**AMERICIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**AMERICIUM 241**
**Biological Radiation Effects**
Biological effects of inhaled radionuclides. Summary of ICRP report 31, 7:1184
**AMERICIUM 242**
**Alpha Decay**
New measurements of partial decay half-lives of the isomeric state of /sup 242m/Am, 7:1598 (INDC(CCP)—135/LN)
**AMERICIUM COMPLEXES**
**Solubility**
Aqueous complexes of metal ions present in the reprocessing of nuclear fuels. Complexes with the ligands orthophenanthroline and dibutyl phosphate, 7:850

**AMINO ACIDS**
*See also CYSTEINE*
*LYSINE*
*THYROXINE*
**Racemization**
Racemization and the origin of asymmetry of biomolecules. Chapter 17, 7:844
Radioracemization of amino acids. Chapter 4, 7:837
**AMINOETHANETHIOL**
*See MEA*
**AMMONIUM PHOSPHATES**
**Chemical Reactions**
Complex use of thermal analysis methods to study interaction of vanadium and titanium oxides with ammonium phosphates, 7:822
Thermal investigation into formatian of condensed phosphates in the $CeO_2$-$NH_4H_2PO_4$ system, 7:821
**Heat Treatments**
Thermal investigation into formatian of condensed phosphates in the $CeO_2$-$NH_4H_2PO_4$ system, 7:821
**AMMONIUM URANATES**
**Chemical Analysis**
Analysis of uranium and some of its compounds and alloys. Silicon spectrophotometric determination, 7:794 (CEA-CETAMA—7)
Analysis of uranium and some of its compounds or alloys. Silicon trace spectrophotometric determination, 7:795 (CEA-CETAMA—7)
Analysis of uranium and of some of its compounds and alloys. Copper spectrophotometric determination, 7:798 (CEA-CETAMA—7)
**AMNIOTIC FLUID**
**Radicimmunoassay**
Alphaphetoprotein RIA without purchases of kits, 7:1066 (INIS-mf—6419)
Testosterone concentration in mother's serum and in amniotic fluid, 7:1112 (INIS-mf—6419)
**AMP**
*(Adenosine monophosphate.)*
**Metabolism**
Delayed stimulatory effect of cyclic AMP on bone resorption, 7:1075
**AMYLUM**
*See STARCH*
**ANDROGENS**
*See also TESTOSTERONE*
**Radioimmunoassay**
Nortestosterone RIA using dual antibody system, 7:1062 (INIS-mf—6419)
**ANGIOGRAPHY**
*See BIOMEDICAL RADIOGRAPHY*
**ANHARMONIC CRYSTALS**
**Bound State**
Two-phonon bound states in imperfect crystals, 7:1653
**ANIMAL CELLS**
*See also SPLEEN CELLS*
*THYMUS CELLS*
*TUMOR CELLS*
**Biological Radiation Effects**
DNA replication and repair in human cells exposed to ionizing radiation, 7:1245 (INIS-mf—6531)
**Biological Repair**
DNA replication and repair in human cells exposed to ionizing radiation, 7:1245 (INIS-mf—6531)
Induction of DNA polymerase activity in irradiated Chinese Hamster cells, 7:1150 (INIS-mf—6531)
**DNA Replication**
DNA replication and repair in human cells exposed to ionizing radiation, 7:1245 (INIS-mf—6531)
**Radiosensitivity**
Of what practical value is knowledge of the cell biology and genetics of radiosensitivity, 7:1164 (INIS-mf—6531)
**ANTARCTICA**
**Aerial Surveying**
Evaluation of uranium resources in Antarctica, 7:127
**Uranium Deposits**
Evaluation of uranium resources in Antarctica, 7:127
**ANTHRACITE**
**Mechanical Properties**
Application of gamma-gamma logging method in the prognosis of anomalous geodynamic effects in hard coal mines, 7:11 (INIS-mf—6422)
**ANTIBODIES**
**Radioimmunoassay**
Methodology of HBsAg, HBsAb and vitamin B 12 concentration determination by RIA, 7:1065 (INIS-mf—6419)
Practical application of hepatitis B antigen and antibody determination by RIA in transfusion services, 7:1064 (INIS-mf—6419)
**ANTIGENS**
**Radioimmunoassay**
Methodology of HBsAg, HBsAb and vitamin B 12 concentration determination by RIA, 7:1065 (INIS-mf—6419)
Practical application of hepatitis B antigen and antibody determination by RIA in transfusion services, 7:1064 (INIS-mf—6419)
Problems of tumour antigen determination, 7:1061 (INIS-mf—6419)
**ANTIMONY**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**AQUATIC ECOSYSTEMS**
**Productivity**
Isotope studies of nitrogen transformations in Castle Lake, California, 7:1010
**Radioactivity**
Radionuclide accumulation in selected components of the aquatic fauna of the Czechoslovak Danube River section, 7:1042 (IAEA-TECDOC—229)
**Radionuclide Migration**
Chemical behaviour and ecological transfer in the human food chain of some radionuclides in aqueous ecosystems, 7:1043 (IAEA-TECDOC—229)
Methodology used for the study of sorption properties of bottom sediments and some basic information on the behaviour of selected radionuclides in aqueous media, 7:1036 (IAEA-TECDOC—229)
**AQUEOUS SOLUTIONS**
**Radiolysis**
Bibliographies on radiation chemistry. 3. Formation and reactivity of the superoxide radical anion, 7:838
**AQUIFERS**
**Hydraulics**
Field determination of the physical contaminant transport parameters in a sandy aquifer, 7:1045
**Hydrology**
Study of the leakage between two aquifers in Hermosillo, Mexico, using environmental isotopes, 7:1018
**Leaks**
Study of the leakage between two aquifers in Hermosillo, Mexico, using environmental isotopes, 7:1018
**Radionuclide Migration**
Field determination of the physical contaminant transport parameters in a sandy aquifer, 7:1045
**Salinity**
Utilization of natural isotopes in the study of salination of the waters in the Pajeu River Valley, northeast Brazil, 7:1019
**Water Quality**
Utilization of natural isotopes in the study of salination of the waters in the Pajeu River Valley, northeast Brazil, 7:1019
**ARAB REPUBLIC OF EGYPT**
*See EGYPTIAN ARAB REPUBLIC*
**ARCHAEOLOGICAL SPECIMENS**
**Activation Analysis**
Applications to archaeology. Chapter 5. Section 5, 7:759

**ARCTIC OCEAN**
**Bathymetry**
Geology of the Barents Sea, 7:45
**Geophysical Surveys**
Geology of the Barents Sea, 7:45
**ARGON**
**Ion Acoustic Waves**
Ion acoustic waves in noble gas ion lasers, 7:901
**Ion-Atom Collisions**
Autoionization in multiply-charged ion-atom collisions, 7:1425
Charge transfer cross sections of $Ne^+$ and $Ne^{++}$ in rare gases, 7:1398
Dynamical effect on the ionization processes in ion-atom collisions, 7:1408
Measurements of double differential cross sections for electrons ejected by 5 - 20 keV $H^+$, $H_2^+$ and $He^+$ impacts on argon, 7:1405
Symmetric resonance electron transfer of multiply charged ions at low energies: A sup(+) + A → A + A sup(q+) (q <= 7), 7:1414
**ARGON 40 REACTIONS**
**Nuclear Reaction Kinetics**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**ARGON 41**
**Spatial Dose Distributions**
Rare gas especially $^{41}Ar$ released from research nuclear reactor and its in-situ measurement, (1), 7:987 (KURRI-TR—179)
Rare gas especially $^{41}Ar$ released from research nuclear reactor and its in-situ measurement, (2), 7:988 (KURRI-TR—179)
**ARGON IONS**
**Beam Production**
High-current DC heavy-ion source, 7:1395
**Collisions**
Temperature dependence of sputtering rate of alkali halides by $Ar^+$ bombardment, 7:1427
**Energy-Level Transitions**
Collisional radiative model for the argon ion system, 7:899
**Ion-Atom Collisions**
Symmetric resonance electron transfer of multiply charged ions at low energies: A sup(+) + A → A + A sup(q+) (q <= 7), 7:1414
**ARID LANDS**
*See also DESERTS*
**Hydrology**
Arid zone hydrology. Investigations with isotope techniques, 7:1031
**Soils**
Injected gamma-tracer method for soil-moisture movement investigations in arid zones, 7:1003
**ARIZONA**
**Uranium Deposits**
Depositional environments as ore controls in salt wash member, Morrison Formation (Upper Jurassic), Carrizo Mountains area, Arizona and New Mexico, 7:107
**AROMATICS**
*See also DDT*
*XYLENES*
**Chemical Reactions**
Aromatic cationic rearrangements. Chapter 4, 7:828
**ARSENIC 73**
**Nuclear Alignment**
Search for anti-aligned states in the A approximately 75 region, 7:1588 (OUP—81-09)
**ASCORBIC ACID**
**Biological Radiation Effects**
Effect of complex preparations on C and P vitamins on the chromosomal aberration formation in hepatocytes of the irradiated rats, 7:1227
**ASTROCYTOMAS**
*See NEOPLASMS*
**ASTROPHYSICS**
**Mathematical Models**
Inverse problems of astrophysics, 7:1287 (JINR-D—12831)
**Photoelectron Counting**
Image photon counting system for space astronomical observations, 7:949
**X-Ray Spectroscopy**
Astro 4 - a sounding rocket programme of the X-ray astronomy, 7:947
**ATOM-ATOM COLLISIONS**
**Excited States**
Collision processes involving excited atoms, 7:1420
**ATOMIC ENERGY LAWS**
Standardization and the atomic energy law, 7:429
**Meetings**
Technical standardization and law. Papers and discussions, 7:430
**ATOM-MOLECULE COLLISIONS**
**Excited States**
Collision processes involving excited atoms, 7:1420
**AUDITORY ORGANS**
**Morphology**
Morphology and ultrastructure of radiation induced tissue damage in rabbit ear chambers, 7:1161 (INIS-mf—6531)
**Radiation Injuries**
In vivo study of effects of ionizing radiation in rabbit ear chambers, 7:1160 (INIS-mf—6531)
**Ultrastructural Changes**
Morphology and ultrastructure of radiation induced tissue damage in rabbit ear chambers, 7:1161 (INIS-mf—6531)
**AUGER ELECTRON SPECTROSCOPY**
Application of multiple technique surface analysis to the study of preferential sputtering and other surface phenomena, 7:1428
**AURORAE**
**Charged-Particle Precipitation**
Auroral particle acceleration: an example of a universal plasma process, 7:1373 (ESA-SP—152)
**Electric Fields**
Sounding rocket observations of field-aligned current sheets, 7:1378 (ESA-SP—152)
**Electron Density**
Sounding rocket observations of field-aligned current sheets, 7:1378 (ESA-SP—152)
Wave-particle interactions in the high altitude auroral ionosphere, 7:1375 (ESA-SP—152)
**Electron Precipitation**
Influence of energy diffusion on auroral particle distributions, 7:1379 (ESA-SP—152)
**Electron Spectra**
Electron spectra over discrete auroras as measured by the substorm-GEOS rockets, 7:1376 (ESA-SP—152)
Some results from the auroral particle experiment on board the barium-GEOS rocket, 7:1377 (ESA-SP—152)
**Proton Density**
Observation of an energetic proton beam and the generation of ULF-waves aboves active auroral forms, 7:1380 (ESA-SP—152)
**AURORAL ZONES**
**Magnetic Fields**
Auroral particle acceleration: an example of a universal plasma process, 7:1373 (ESA-SP—152)
**AUSTENITIC STEELS**
**Corrosion**
Effect of liquid sodium on behaviour of selected structural materials for steam generators of fast power reactors, 7:648 (INIS-mf—6423)
Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358
**Creep**
Results of study in long-term properties of austenitic steels in liquid sodium, 7:649 (INIS-mf—6423)
**Crystal-Phase Transformations**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**Fracture Properties**
Fracture toughness of nitrogen strengthened austenitic steels at 4K, 7:674

**Physical Radiation Effects**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**Thermal Fatigue**
Study on thermal fatigue endurance under biaxial stress state, 7:663
**AUSTRALIA**
*See also NORTHERN TERRITORY*
*QUEENSLAND*
**Hydrology**
Aspects of the isotope hydrology of two sandstone aquifers in arid Australia, 7:1017
**Resource Assessment**
Australia's mineral energy resources: assessment and potential. Proceedings of a seminar held in Sydney, 1978, 7:124
**Resource Potential**
Australia's mineral energy resources: assessment and potential. Proceedings of a seminar held in Sydney, 1978, 7:124
**Uranium Deposits**
Development of the Alligator Rivers uranium deposits, 7:154
Western Australian conference 1979. Proceedings of the Australian Institute of Mining and Metallurgy conference held in Perth, Australia, August 12-17, 1979, 7:123
**Uranium Mines**
Development of the Alligator Rivers uranium deposits, 7:154
**AUSTRIA**
**Nuclear Power**
Nuclear energy controversy in Austria. A sociological problem, 7:616

## B

**BACTERIAL SPORES**
**Chemical Radiation Effects**
Radiation effects on electrophoretic properties of bacterial spores, 7:1153 (INIS-mf—6531)
**Electrophoresis**
Radiation effects on electrophoretic properties of bacterial spores, 7:1153 (INIS-mf—6531)
**BACTERIOPHAGES**
**Response Modifying Factors**
Effect of bacteriophage C5 on ultraviolet survival in Pseudomonas aeruginosa, 7:1156 (INIS-mf—6531)
**BAG MODEL**
**Hadron Reactions**
Colour confinement effects in the presence of nuclear matter, 7:1549
**Transition Amplitudes**
M.I.T. bag model, mass differences, and $q^3\,q^{-3}$ states of hidden colour, 7:1525 (IPNO-TH—80-49)
**BARC**
*(Bhabha Atomic Research Center.)*
**Spent Fuel Elements**
Post-irradiation examination at Radiometallurgy Division, BARC, Bombay, 7:341
**BARIUM**
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**BARIUM COMPOUNDS**
**Entropy**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**Specific Heat**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**BARSEBAECK-1 REACTOR**
**Fuel-Cladding Interactions**
Operation with monosequences in ASEA-ATOM BWR. A way of reducing the impact of PCI, 7:279 (IWGFPT—8)
**BARSEBAECK-2 REACTOR**
**Fuel-Cladding Interactions**
Operation with monosequences in ASEA-ATOM BWR. A way of reducing the impact of PCI, 7:279 (IWGFPT—8)
**BARYONIUM**
**Antilambda Particles**
Observation of new lambda anti lambda states, 7:1495
**Color Model**
Colour isomers in multiquark systems, 7:1517
**Electromagnetic Particle Decay**
Electromagnetic decay widths for L=1 Jsup(PC) = $1^{--}$ T-baryonia, 7:1508
**Lambda Particles**
Observation of new lambda anti lambda states, 7:1495
**Multiple Production**
Structure of baryonium and its manifestation in multiparticle production processes, 7:1518
**BASALT**
**Thermal Conductivity**
Thermal conductivity of selected repository minerals, 7:197
**BASEDOW'S DISEASE**
*See HYPERTHYROIDISM*
**BATTERIES (ELECTRIC)**
*See ELECTRIC BATTERIES*
**BAY OF BISCAY**
**Geologic History**
Petroleum geology of the Bay of Biscay, 7:52
**Petroleum Geology**
Petroleum geology of the Bay of Biscay, 7:52
**BEAGLES**
**Dose-Response Relationships**
RBE of $\alpha$-particles versus $\beta$-particles in bone sarcoma induction, 7:1185
**BEAM MONITORING**
**Energy Spectra**
Energy and energy spectra measuring, 7:923
**BEAM MONITORS**
Beam detection and dose measurement, 7:917
**BEAM PROFILES**
**Magnetoinduction Sensors**
Determination of the position of the center of gravity of a beam, 7:924
**BEAM TRANSPORT**
Beam transport for ion implantation, 7:910
Low-energy ion beam transport by permanent magnets, 7:911
**BELLOWS**
**Mechanical Properties**
Mechanical static analysis of JET vacuum vessel, 7:1700
**BENCHMARKS**
**Computerized Simulation**
Iterative multigroup cross-section adjustment procedure, 7:452
**BENTONITE**
Highly compacted bentonite: a self-healing substance for nuclear waste isolation, 7:219
**Sorptive Properties**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**BENZOPHENONE**
**Photochemistry**
Formation of two photoenols via a common pathway in the photochemistry of 2-methylbenzophenone, 7:833
**BERKELIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**BERYLLIUM**
**Chemical Analysis**
Beryllium analysis. Chlorine turbidimetric determination, 7:796 (CEA-CETAMA—7)
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701

**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)

**BERYLLIUM 9 TARGET**
**Electron Reactions**
Exchange internucleon interactions in deep inelastic electron scattering by nuclei, 7:1565 (KFTI—79-48)
**Kaon Minus Reactions**
($K^-,\pi^-$) strangeness exchange reaction on $^6$Li, $^7$Li, and $^9$Be, 7:1579 (TRI—79-1)
Excited states in light hypernuclei from ($K^-,\pi^-$) reactions, 7:1580 (TRI—79-1)
Possible observation of a $\gamma$-transition in the $\Lambda^8$Li hypernucleus, 7:1581 (TRI—79-1)
Search for $\Sigma$ hypernuclei by means of the strangeness-exchange reactions ($K^-,\pi^-$) and ($K^-,\pi^+$), 7:1582 (TRI—79-1)

**BERYLLIUM MODERATORS**
*See BERYLLIUM*

**BETA BACKSCATTERING GAGES**
*See RADIOMETRIC GAGES*

**BETA-PLUS DECAY RADIOISOTOPES**
**Coincidence Methods**
Specific counting techniques. Chapter 3. Section 5, 7:752

**BIBLIS-A REACTOR**
**Failed Element Detection**
Detection of failed fuel rods in irradiated fuel assemblies, 7:307

**BICARBONATES**
*See ACID CARBONATES*

**BINARY FISSION**
Multi-centre shell model, 7:1631

**BIOFLAVONOIDS**
**Biological Radiation Effects**
Effect of complex preparations on C and P vitamins on the chromosomal aberration formation in hepatocytes of the irradiated rats, 7:1227

**BIOLOGICAL MATERIALS**
*(See also specific biological materials.)*
*See also AMNIOTIC FLUID*
*BLOOD*
**Chemical Radiation Effects**
Fundamentals of the theory of radiation impact processes in crystalline amino acids, proteins and quasiperiodic biological structures. Pt.2, 7:1142 (INIS-mf—6304)
**Mass Spectroscopy**
Mass spectrometry, 7:763

**BIOLOGICAL REPAIR**
**Radioinduction**
Induction of DNA polymerase activity in irradiated Chinese Hamster cells, 7:1150 (INIS-mf—6531)

**BIOMEDICAL RADIOGRAPHY**
**Radiation Hazards**
Problems of image quality, radiation burden and risk/benefit ratio in mammography, 7:1244 (INIS-mf—6421)

**BIOPSY**
Combined application of radiology, nuclear medicine and fine needle aspiration biopsy cytology (FNAB), 7:1088
CT guided percutaneous fine needle aspiration of intra-abdominal and pelvic masses, 7:1095
X-ray guided biopsy, 7:1096

**BITUMENS**
**Comparative Evaluations**
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
**Physical Radiation Effects**
Absorption of dose rate in great bitumen blocks. Experimental detection, 7:240

**BLACK COAL**
**Mechanical Properties**
Application of gamma-gamma logging method in the prognosis of anomalous geodynamic effects in hard coal mines, 7:11 (INIS-mf—6422)

**BLANKETS (BREEDING)**
*See BREEDING BLANKETS*

**BLOOD**
*See also BLOOD CELLS*
**Dialysis**
Acute effect of haemodialysis on thyroid hormone level, 7:1111 (INIS-mf—6419)

**BLOOD CELLS**
*See also ERYTHROCYTES*
*LEUKOCYTES*
**Hemolysis**
Autosensibilization of organism in different pathologic states and radiotherapy of oncologic patients, 7:1220
**Morphological Changes**
Dynamics of hematologic indices in patients with breast cancer in megavolt gamma therapy, 7:1235

**BLOOD CIRCULATION**
**Age Dependence**
Method of radioisotopic indication with chromium-51 in the evaluation of circulating blood volume in persons of different age, 7:1115
**Biomedical Radiography**
Study on after-actions of transient damages of cerebral circulation in patients with erythremia by the radiocirculography method, 7:1106

**BLOOD CLOTTING**
*See BLOOD COAGULATION*

**BLOOD COAGULATION**
**Biological Radiation Effects**
Thrombelastographic indices in patients with syringomyelia treated with radioactive iodine, 7:1241

**BLOOD COAGULATION FACTORS**
**Biological Radiation Effects**
Changes in thrombelastographic indices in patients with thyrotoxicosis treated with radioactive iodine, 7:1242

**BLOOD FLOW**
**Measuring Instruments**
Portable device for the measurement of regional cerebral blood flow in the ICU and Or using Cd Te detectors and a fourier transform based data analysis, 7:1087

**BLOOD SERUM**
**Calcium**
Comparison of bone resorption and bone-blood calcium equilibrium in vertebrates, 7:1081
Differences in response of serum calcium, $^{45}$calcium, and $^3$H-tetracycline to parathyroid hormone in normal and calcium-deficient dogs, 7:1080
**Radioimmunoassay**
Testosterone concentration in mother's serum and in amniotic fluid, 7:1112 (INIS-mf—6419)

**BOILERS**
**Transients**
BESBET 2 - a computer code for the simulation of severe transients in LMFBR boilers, 7:423

**BOILING**
**Finite Difference Method**
Comparison of some implicit finite difference schemes used in flow boiling analysis, 7:903

**BOILING WATER REACTORS**
*See BWR TYPE REACTORS*

**BOLTZMANN COLLISION INTEGRAL**
*See BOLTZMANN EQUATION*

**BOLTZMANN EQUATION**
**Distribution Functions**
Relation between mobility and diffusion in swarms, 7:1469

**BOLTZMANN TRANSPORT EQUATION**
*See BOLTZMANN EQUATION*

**BONE CELLS**
**Dynamic Function Studies**
Quantitative 99mTc-diphosphonate whole body retention, plasma PTH and bone loss in oophorectomized women, 7:1076

**BONE DISEASES**
*See SKELETAL DISEASES*

**BONE FRACTURES**
**Radiosensitivity Effects**
Operative intervention effect on hematopoietic state in irradiated rats, 7:1209

**BONE MARROW**
**Transplants**
Total body irradiation on bone marrow transplantation, 7:1084 (INIS-mf—6531)
**BONE MARROW CELLS**
**Biological Radiation Effects**
Morphological and biochemical changes in genesis of postradiation interphase cell killing, 7:1210
**Ultrastructural Changes**
Some changes in ultrastructure of bone marrow cells in its aplastic states, 7:1212
Some peculiarities of ultrastructural changes of bone marrow myeloid and erythroid sprouts of rats in acute radiation injury, 7:1229
**BONE TISSUES**
**Biological Radiation Effects**
Molecular and endocrine mechanisms of postradiation changes in reactivity of bone tissues, 7:1211
**Radiation Injuries**
Study on bone tissue diffraction picture of irradiated rats of different age, 7:1207
**BONES**
*See SKELETON*
**BOREHOLES**
**Geophysical Surveys**
Geophysical experiments at Mariano Lake uranium orebody, 7:140
**Temperature Gradients**
Temperature, thermal gradients and heat flow in the southwestern North Sea, 7:23
**Temperature Logging**
Geothermal gradients of the Northern North Sea Basin, 59 to 62°N, 7:24
**BORN-GREEN-YVON EQUATION**
*See BOLTZMANN EQUATION*
**BORON**
**Spectrophotometry**
Analysis of plutonium and its nitric solutions. Boron spectrophotometric determination, 7:799 (CEA-CETAMA—7)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
**BORON 10 TARGET**
**Electron Reactions**
Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48)
**BORON 11 TARGET**
**Electron Reactions**
Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48)
**BORON ISOTOPES**
**Isotope Ratio**
Isotopic analysis of lithium, boron and magnesium and their importance in nuclear technology, 7:780
**BOROSILICATE GLASS**
**Chemical Composition**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**Comparative Evaluations**
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
**Leaching**
Mechanisms for hydrothermal leaching of glass and glass-ceramic nuclear waste forms, 7:717
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
Recent progress on SYNROC development, 7:205
**Stability**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**BOROSILICATES**
*See BOROSILICATE GLASS*
**BOSONS**
*See also MESONS*
**Interacting Boson Model**
Bosons and groups in nuclear physics, 7:1506
**BRAIN**
**Blood Circulation**
Study on after-actions of transient damages of cerebral circulation in patients with erythremia by the radiocirculography method, 7:1106
**Positron Computed Tomography**
New tomograph for quantitative positron emission computed tomography of the brain, 7:1118
**BRAZIL**
**Aquifers**
Utilization of natural isotopes in the study of salination of the waters in the Pajeu River Valley, northeast Brazil, 7:1019
**Natural Radioactivity**
Two decades of research in the Brazilian areas of high natural radioactivity, 7:1189
**Regional Analysis**
Two decades of research in the Brazilian areas of high natural radioactivity, 7:1189
**BREAKWATERS**
*See DAMS*
**BREASTS**
*See MAMMARY GLANDS*
**BREEDING BLANKETS**
**Design**
Engineering design of a direct-cycle steam-generating blanket for a long-pulse fusion reactor, 7:1702
**Hydraulics**
Thermal analysis of a high-temperature falling bed fusion reactor blanket, 7:1687
**Stress Analysis**
Stress analysis of blanket vessel for JAERI experimental fusion reactor, 7:1699
**Wall Loading**
First wall and blanket structure performance, 7:1697
**BRINES**
**Radionuclide Migration**
Predicting the reaction state of brines in proposed regions of nuclear waste isolation (Computer model AQ/SALT), 7:195
**BROMIDES**
**Mass Spectroscopy**
Mass spectrometric isotope dilution analysis of trace amounts of halides, 7:765
**BUILDING MATERIALS**
*See also CEMENTS*
*CONCRETES*
**Radiation Hazards**
Assessment of biological effects resulting from large scale applications of coal power plant wastes in building technology in Poland, 7:1196
**Waste Product Utilization**
Assessment of biological effects resulting from large scale applications of coal power plant wastes in building technology in Poland, 7:1196
**BUILDINGS (CONTAINMENT)**
*See CONTAINMENT BUILDINGS*
**BUNDLE DIVERTORS**
**Performance**
Experimental results from the DITE bundle divertor, 7:1678
**BWR TYPE REACTORS**
*See also BARSEBAECK-1 REACTOR*
*BARSEBAECK-2 REACTOR*
*COOPER REACTOR*
*GUNDREMMINGEN-2 REACTOR*
*OKG-1 REACTOR*
*OKG-2 REACTOR*
*TARAPUR-1 REACTOR*
*TARAPUR-2 REACTOR*
**Containment**
Unconventional dynamic behaviour of thin spherical containment shells. A semi-analytical description, 7:600
**Containment Buildings**
Computer program system for structural design of nuclear power plants, 7:576
Nonlinear analysis of a BWR reactor building subjected to both thermal and earthquake loadings, 7:574
Performance of Scandinavian BWR-containments during pressure tests, 7:572
Structure-to-structure interaction analysis for a nuclear power plant, 7:573

**Containment Systems**
Super element model development and analysis on the Mark I torus structure, 7:577
**Coolant Cleanup Systems**
Condensate clean up control system with distributed DDC, 7:276 (AECL—7056)
**Fuel Cycle**
Recycling of actinides in light water reactors, 7:431
**Fuel-Cladding Interactions**
Pellet-cladding interactions. Detection and location of PCI defects through fission product release during reactor operation/transients and the concept of cumulative PCI damage, 7:278 (IWGFPT—8)
**Leak Detectors**
Leak detection system with distributed microprocessor in the primary containment vessel, 7:535 (AECL—7056)
**Off-Gas Systems**
Released rare gas and its hold-up in nuclear power plant, 7:280 (KURRI-TR—179)
**Pipes**
Experimental study of pipe reaction force and jet impingement load at the pipe break, 7:288
**Reactor Components**
Dynamic pressures in annulus-shaped pressure suppression pools of boiling water reactors generated by earthquake ground motions, 7:575
Some aspects of the interaction between systems- and structural reliability, 7:578
**Reactor Control Systems**
Distributed control and data processing system with a centralized database for a BWR power plant, 7:526 (AECL—7056)
**Spent Fuel Elements**
Analytical procedures using instruments in the post-irradiation examination of fuels, 7:285
Computer controlled nondestructive testing on the irradiated fuel rod, 7:283
**Two-Phase Flow**
Study of transient air injection into a pool of water, 7:282

## C

**CADARACHE (CEA)**
*See CEA CADARACHE*
**CADARACHE RAPSODIE REACTOR**
*See RAPSODIE REACTOR*
**CADMIUM**
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**CADMIUM FLUORIDES**
**Energy Levels**
Temperature dependant decay of metastable state of systems with large impurity-lattice relaxation ($CdF_2$:In), 7:726
**Impurities**
Temperature dependant decay of metastable state of systems with large impurity-lattice relaxation ($CdF_2$:In), 7:726
**CADMIUM TELLURIDES**
**Recombination**
Recombination in narrow-gapped semiconductors, 7:712 (INIS-mf—6449)
**CALANDRIAS**
**Mechanical Vibrations**
Analysis of colliding vibration of two cylinders, 7:460
**CALCINED WASTES**
**Comparative Evaluations**
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
**CALCITE**
**Sorptive Properties**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**CALCITONIN**
**Biological Radiation Effects**
Ionizing radiation effect on calcitonin production system in rats of various ages, 7:1230
**Radiosensitivity**
Molecular and endocrine mechanisms of postradiation changes in reactivity of bone tissues, 7:1211
**CALCIUM**
**Absorption Spectroscopy**
Stable product low leach glasses, 7:202
**Activation Analysis**
Determination of oxygen, carbon and nitrogen in calcium by the gamma activation method, 7:742 (KFTI—79-40)
**Ion-Atom Collisions**
Contribution of electron transfer to K-shell ionizations by $N^{7+}$-ion bombardment, 7:1415
**Leaching**
Stable product low leach glasses, 7:202
**Membrane Transport**
Ionized calcium concentrations in Krebs-Ringer bicarbonate buffers (KRBB) and their effect on mineral transport across intestinal mucosa and placenta, 7:1079
**Metabolism**
Postoperative hypoparathyroidism followed by Parkinsonium, 7:1174
**Spectroscopy**
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**CALCIUM 40 TARGET**
**Kaon Plus Reactions**
Neutron density studies through $K^+$-nucleus scattering, 7:1503 (TRI—79-1)
**Kaon Reactions**
Kaon elastic and inelastic scattering at 800 MeV/c, 7:1483 (TRI—79-1)
**CALCIUM 41**
**Energy-Level Transitions**
Collective bands of positive parity states in (FP) shell nuclei, 7:1586
**CALCIUM 45**
**Radionuclide Kinetics**
Stimulation of $^{45}Ca$ release from bone by embryonic chick parathyroid glands in vitro, 7:1175
**CALCIUM 48 TARGET**
**Kaon Plus Reactions**
Neutron density studies through $K^+$-nucleus scattering, 7:1503 (TRI—79-1)
**CALCIUM CHLORIDES**
**Solvent Properties**
$SrCl_2$ solubility in complex brines, 7:814
**CALCIUM COMPOUNDS**
**Entropy**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**Specific Heat**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**CALCIUM PHOSPHATES**
**Phase Studies**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**Synthesis**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**CALCIUM SILICATES**
**Redox Reactions**
Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses, 7:201

**CALDER HALL A-1 REACTOR**
**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369
**CALDER HALL A-2 REACTOR**
**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369
**CALDER HALL B-3 REACTOR**
**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369
**CALDER HALL B-4 REACTOR**
**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369
**CALIFORNIA**
*See also GEYSERS GEOTHERMAL FIELD*
**Energy Demand**
California energy futures: a presentation made to the California Energy Commission, 7:628 (P—300-80-033)
**CALIFORNIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**CALORIMETRIC DOSEMETERS**
**Gamma Dosimetry**
Review of session L: dosimetry techniques, 7:925 (EUR—6813(Vol.2))
**Neutron Dosimetry**
Review of session L: dosimetry techniques, 7:925 (EUR—6813(Vol.2))
**CALORIMETRY**
**Meetings**
Meeting on calorimetry and thermal analysis, 7:811
**CAMAC SYSTEM**
*(Computer Application to Measurement And Control.)*
**Microprocessors**
CAMAC-monitor for MPS 4944 and SDK-80 microcomputers, 7:1707 (ZfK—410)
**Real Time Systems**
Real-time basic - principles and implementation for KRS 4200 minicomputers, 7:1706 (ZfK—410)
**Test Facilities**
CAMAC system test module, 7:1709
**CAMP**
*See AMP*
**CANADA**
*See also NORTHWEST TERRITORIES*
*ONTARIO*
*SASKATCHEWAN*
**Engineering**
Engineer's view of science education, 7:1705 (NP—2900461)
**Nuclear Industry**
Public attitudes towards the nuclear industry in Canada, 7:617
**Nuclear Power**
Trends in public opinion. The national scene, 7:625
**Nuclear Trade**
International nuclear trade and non-proliferation issues. Some Canadian views, 7:621
**Uranium Mines**
Uranium mining. A review of 1979 developments, 7:151
**CANADA-INDIA REACTOR**
*See CIRUS REACTOR*
**CANADIAN AECB**
*(Canadian Atomic Energy Control Board.)*
**Reactor Licensing**
Reactor safety requirements in times of change, 7:568
**CANCER**
*See NEOPLASMS*
**CANDU TYPE REACTORS**
*See also CORDOBA REACTOR*
*GENTILLY-2 REACTOR*
*POINT LEPREAU-1 REACTOR*
*RAJASTHAN-1 REACTOR*
*RAJASTHAN-2 REACTOR*
*WOLSUNG-1 REACTOR*
**Construction**
Design and construction progress on Gentilly 2, Cordoba, Point Lepreau, and Wolsung projects, 7:382
**Containment Buildings**
Coupled lateral-torsional response of equipment mounted in CANDU nuclear power plants, 7:595
Mechanistic assessment of structural failure for missile impacts on concrete structures, 7:393
**Containment Shells**
Behaviour of concrete containment under over-pressure conditions, 7:386
Modelling and predicting behavior of prestressed concrete secondary containment structures using BOSOR 5, 7:387
Test of a model of a thin-walled prestressed concrete secondary containment structure, 7:388
**Failure Mode Analysis**
Protection from common-mode events, 7:604
**Flanges**
Tests on a 1,75 m O.D. bolted flange assembly with spiral-wound gaskets, 7:391
**Personnel Monitoring**
Personal tritium monitor, 7:383
**Pressure Tubes**
Analysis of pressure tube elongation and end shield interactions in the CANDU reactors, 7:389
**Radiation Monitors**
Personal tritium monitor, 7:383
**Reactor Control Systems**
Hierarchy of essential CANDU reactor control functions in a distributed system, 7:537 (AECL—7056)
Impact of data highway architectures on control and instrumentation design, 7:532 (AECL—7056)
**Reactor Cores**
Forced vibration test of 1/5 scale model of Candu core, 7:596
**Reactor Safety**
Safety design, 7:603
**Relief Valves**
Nonlinear transient dynamic response of pressure relief valves for a negative containment system, 7:392
**Risk Assessment**
Protection from common-mode events, 7:604
Safety design, 7:603
**Steam Generators**
Seismic interaction effects for steam generators in CANDU 600 MWe nuclear power plants, 7:594
**CANONICAL QUANTUM FIELD THEORY**
*See LAGRANGIAN FIELD THEORY*
**CAP ROCK**
**Neutron-Gamma Logging**
Study of the tightness of the rock cover of the Suchohrad-Gajary underground natural gas reservoirs using nuclear logging methods, 7:58 (INIS-mf—6422)
**Neutron-Neutron Logging**
Study of the tightness of the rock cover of the Suchohrad-Gajary underground natural gas reservoirs using nuclear logging methods, 7:58 (INIS-mf—6422)
**CARBON**
*See also DIAMONDS*
*GRAPHITE*
**Activation Analysis**
Determination of oxygen, carbon and nitrogen in calcium by the gamma activation method, 7:742 (KFTI—79-40)
Gamma activation analysis of organogenic elements in biologically active organometallic compounds, 7:743 (KFTI—79-40)
**Chemical Composition**
Carbon deposition on 20/25/Nb steel using an electrically heated AGR fuel pin, 7:359

**Chemical Reaction Yield**
Effect of surface pretreatment on the growth of carbon onto stainless steel from the decomposition of propane, 7:825
Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839
**Deposition**
Carbon deposition on iron and steel surfaces, 7:659
Carbon formation processes relevant to advanced carbon dioxide-cooled reactors, 7:357
Effect of surface pretreatment on the growth of carbon onto stainless steel from the decomposition of propane, 7:825
Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839
Oxidation of carbonaceous deposit in nuclear reactors, 7:365
Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358
**Gasification**
Radiolytic carbon gasification, 7:840
**Ion Collisions**
Electron capture and loss to, or from wake-riding states by fast ions in metals, 7:1418
**Oxidation**
Oxidation of carbonaceous deposit in nuclear reactors, 7:365
**Phase Diagrams**
Phase equilibria in the uranium-chromium-carbon system, 7:671
**Quantitative Chemical Analysis**
Sodium sampling and impurities determination, 7:741 (INIS-mf—6423)
**Tetragonal Lattices**
Phase equilibria in the uranium-chromium-carbon system, 7:671
**CARBON 12**
**Isotope Effects**
High-resolution spectroscopy of the 16-$\mu$m bending fundamental of $CF_4$, 7:829
**CARBON 12 TARGET**
**Alpha Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**Carbon 12 Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**Cross Sections**
Electron quasi-free scattering by atomic nuclei in the interaction time approximation, 7:1560 (KFTI—79-48)
**Deuteron Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**Electron Reactions**
Cross section of electron elastic scattering with $^{12}C$ nucleus as a reference standard for relative measurements, 7:1578 (KFTI—80-6)
Effects of final-state interactions in the $^{12}C(e,e'p)^{11}B$ reaction, 7:1577 (KFTI—80-6)
Exchange internucleon interactions in deep inelastic electron scattering by nuclei, 7:1565 (KFTI—79-48)
Influence of dynamic correlations and of nuclear structure effects on the form factors of excitation of light nuclei by fast electrons, 7:1571 (KFTI—79-48)
Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48)
**Kaon Minus Reactions**
Search for $\Sigma$ hypernuclei by means of the strangeness-exchange reactions $(K^-,\pi^-)$ and $(K^-,\pi^+)$, 7:1582 (TRI—79-1)
**Kaon Reactions**
Kaon elastic and inelastic scattering at 800 MeV/c, 7:1483 (TRI—79-1)
**Photonuclear Reactions**
Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV, 7:1576 (KFTI—80-6)
Pion photoproduction on bound nucleons, 7:1575 (KFTI—80-6)
Study of the $(\gamma, \pi^0 p)$ reaction of $^6Li$, $^{12}C$ and $^{16}O$ nuclei in a wide range of transferred momentum, 7:1574 (KFTI—80-6)
**Pion Minus Reactions**
Coherent (1), semicoherent (2) and incoherent (3) interactions on nuclei at 40 GeV/c, 7:1491
**Proton Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
Proton-nucleus interactions at intermediate energies accompanied by fast proton backwards emission, 7:1570 (ITEF—129(1979))
**CARBON 13**
**Isotope Effects**
High-resolution spectroscopy of the 16-$\mu$m bending fundamental of $CF_4$, 7:829
**CARBON 14**
**Isotope Effects**
High-resolution spectroscopy of the 16-$\mu$m bending fundamental of $CF_4$, 7:829
**CARBON DIOXIDE**
O-positronium pick-off quenching in dense gases, 2. Experimental results in xenon and carbon dioxide, 7:1432
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
Charge transfer cross sections of $He^+$ and $Ne^+$ in carbon-containing molecules, 7:1417
**Methanation**
Methanation of carbon dioxide over a ruthenium catalyst for AGR gas circuit composition control, 7:248
**Photolysis**
Some gaseous reactions in carbon dioxide based coolants, 7:832
**Radiolysis**
Calculation of methane profiles in graphite structures, 7:722
Carbon deposition on 20/25/Nb steel using an electrically heated AGR fuel pin, 7:359
Carbon formation processes relevant to advanced carbon dioxide-cooled reactors, 7:357
Development of transport and non-transport porosity in radiolytic graphite oxidation, 7:721
Graphite oxidation experiment to high weight loss under CAGR conditions, 7:362
Implications of radiolytic graphite corrosion on AGR brick integrity, 7:364
Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839
Modelling of AGR radiolytic graphite corrosion, 7:363
Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
Radiolytic carbon gasification, 7:840
Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358
Trace organics in AGR coolants, 7:367
**CARBON DIOXIDE LASERS**
**Electrical Pumping**
Theoretical and experimental investigations of the electrical excitation rates in TEA-$CO_2$-lasers, 7:890
**Radiation Hazards**
Occupational exposures associated with laser heat sealers, 7:991
**CARBON IONS**
**Ion-Ion Collisions**
Charge transfer in proton-hydrogenlike ion collision in a modified coulomb-born approximation, 7:1419
**CARBON ISOTOPES**
**Mass Spectroscopy**
Instrumental effects in the application of static mass spectrometry to high-sensitivity carbon isotope measurements, 7:764
New automated mass spectrometer for high precision isotope ratio determinations of gases, 7:785
**CARBON MONOXIDE**
**Ion-Molecule Collisions**
Charge transfer cross sections of $He^+$ and $Ne^+$ in carbon-containing molecules, 7:1417
**Radiolysis**
Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839

Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
Trace organics in AGR coolants, 7:367

**CARBON STEELS**
*See also STEEL-ASTM-A533-B*
**Thermal Fatigue**
Study on thermal fatigue endurance under biaxial stress state, 7:663

**CARBON TETRAFLUORIDE**
**Laser Spectroscopy**
High-resolution spectroscopy of the 16-μm bending fundamental of $CF_4$, 7:829

**CARBONATE ROCKS**
**Resource Potential**
Zechstein facies and petroleum prospects in the central and northern North Sea, 7:26

**CARCINOGENESIS**
**Radiation Hazards**
Carcinogenic and genetic hazards from environmental, medical and industrial radiation sources, 7:1171 (INIS-mf—6531)
**Response Modifying Factors**
Neoplasm appearance resulting from chronic intake of mixtures of radium-226, strontium 90, ddt, 7:1233

**CARCINOGENS**
**Synergism**
Combined carcinogenic effects of ionizing radiation and chemical molecules, 7:1197

**CARCINOMAS**
**Metastases**
Diagnosis of bone metastases in breast carcinoma by isotope technique with abbreviated recording, 7:1113 (INIS-mf—6421)
**Radiosensitivity**
Role of ultraviolet light in bovine ocular squamous cell carcinoma (BOSCC:, 7:1148 (INIS-mf—6531)
**Radiotherapy**
Formation of autohemolysins in radiotherapy of oncologic patients, 7:1239

**CARDIAC OUTPUT**
*See BLOOD CIRCULATION*

**CARDIOVASCULAR SYSTEM**
**Pathological Changes**
Hemodynamic changes in patients with cervix uteri carcinoma in the process of combined radiotherapy according to the data of arterial oscillography, 7:1218
**Radiosensitivity**
Dynamics of radiocardiographic indices in radiation treatment of patients with mammary gland cancer, 7:1214

**CASCADE SHOWERS**
Observation of an excess of events in $e^+e^-$ annihilations into neutral final-states leading to three electromagnetic showers at 10 GeV, 7:1496

**CASCADE SOLAR CELLS**
Research and device problems in photovoltaics, 7:254

**CASKS**
**Decontamination**
Decontamination techniques suitable for post-irradiation examination caves, 7:846
**Impact Tests**
Comparison of potentional crush and impact environments, 7:856 (INIS-mf—6447)
**Leaks**
Investigation of gas leakage from sealing constructions at containments for radioactive materials, 7:860 (INIS-mf—6447)
**Safety**
Rescue container to accommodate defective transport containers filled with uranium hexafluoride, 7:859 (INIS-mf—6447)

**CAST IRON**
**Corrosion**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217

**CATAPHORESIS**
*See ELECTROPHORESIS*

**CATHODES**
**Electric Discharges**
Behaviour of carbon fibre cathodes in vacuum discharges, 7:1447
Influence of surface contamination on cathode erosion by nanosecond discharges in vacuum, 7:1448
Minimum conditions for cathode erosion by electrical discharges in UHV, 7:1446
**Electron Emission**
Processes at cathode operating in regime of electron explosive emission, 7:1445
**Erosion**
Influence of surface contamination on cathode erosion by nanosecond discharges in vacuum, 7:1448
Minimum conditions for cathode erosion by electrical discharges in UHV, 7:1446

**CATTLE**
**Carcinomas**
Role of ultraviolet light in bovine ocular squamous cell carcinoma (BOSCC:, 7:1148 (INIS-mf—6531)

**CDTE SEMICONDUCTOR DETECTORS**
**Diagnostic Uses**
Portable device for the measurement of regional cerebral blood flow in the ICU and Or using Cd Te detectors and a fourier transform based data analysis, 7:1087

**CEA**
*(Commissariat a l'Energie Atomique.)*
*See also CEA CADARACHE*
*CEA SACLAY*
**Radiation Monitors**
Use of informatic for radiation control panels, 7:951

**CEA CADARACHE**
**Radioactive Waste Management**
Experience of management of plutonium-contaminated solid and liquid wastes at the Cadarache Nuclear Research Centre, 7:191

**CEA SACLAY**
**Hot Cells**
Refurbishing of the hot cell Celimene for the post-irradiation examination of PWR assemblies, 7:864

**CELL KILLING**
**Radioinduction**
Repair and actio spectrum of oxygen-independent lethality of near uv light on Haemophilus influenzae and lack of mutation, 7:1204

**CELL MEMBRANES**
**Permeability**
Permeability state of microcirculatory channel of some organs in rabbits under conditions of pyocyanic infections process, 7:1121

**CELLS (ANIMAL)**
*See ANIMAL CELLS*

**CEMENTS**
**Leaching**
Leach and corrosion tests under normal and accident conditions on cement products from simulated intermediate level evaporator concentrates, 7:213
**Sorptive Properties**
Diffusion of cesium in concrete, 7:210
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216

**CENTRAL HEATING PLANTS**
**Steam Generators**
Operating experience with a fluidized bed steam generator at Georgetown University, 7:905 (CONF-8004173—11)

**CERAMICS**
**Activation Analysis**
Applications to archaeology. Chapter 5. Section 5, 7:759
**Chemical Composition**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**Comparative Evaluations**
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
**Leaching**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217

Mechanisms for hydrothermal leaching of glass and glass-ceramic nuclear waste forms, 7:717
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
Stability of pollucite in hydrothermal fluids ($CsAlSi_2O_6$-pollucite), 7:705
Tailored ceramic nuclear waste forms: preparation and characterization, 7:204

**Meetings**
Austceram 80. Proceedings of the 9th Australian ceramic conference held at Sydney, August 1980, 7:709

**Stability**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715

**Structural Chemical Analysis**
Tailored ceramic nuclear waste forms: preparation and characterization, 7:204

**CERIUM**

**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212

**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**CERIUM 140 TARGET**

**Oxygen 16 Reactions**
High spin isomeric states in $^{152}$Dy, 7:1592 (INP—1014/PL)

**CERIUM 144**

**Biological Radiation Effects**
Biological effects of inhaled radionuclides. Summary of ICRP report 31, 7:1184

**CERIUM OXIDES**

**Chemical Reactions**
Thermal investigation into formatian of condensed phosphates in the $CeO_2$-$NH_4H_2PO_4$ system, 7:821

**Heat Treatments**
Thermal investigation into formatian of condensed phosphates in the $CeO_2$-$NH_4H_2PO_4$ system, 7:821

**CERN II SYNCHROTRON**
*See CERN SPS SYNCHROTRON*

**CERN SPS SYNCHROTRON**

**Control Systems**
Selection case history, minicomputer network control of a large nuclear particle accelerator. Chapter 7.6, 7:915

**CESIUM**

**Corrosive Effects**
Metallographic investigation into interaction of cesium with some metals, 7:701

**Ion Exchange**
Stability of pollucite in hydrothermal fluids, 7:705

**Leaching**
Leach and corrosion tests under normal and accident conditions on cement products from simulated intermediate level evaporator concentrates, 7:213
Recent progress on SYNROC development, 7:205
Stability of pollucite in hydrothermal fluids, 7:705

**Population Inversion**
Inversion of excited atom states in cesium and nitrogen-cesium plasma, 7:896

**CESIUM 134**

**Diffusion**
Diffusion of cesium in concrete, 7:210

**Distribution Functions**
Diffusion of cesium in concrete, 7:210

**Leaching**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209

**Sorption**
Diffusion of cesium in concrete, 7:210

**Uptake**
In vitro studies of the cellular transport of radioactive caesium-134m in rat thyroid tissue, 7:1167 (INIS-mf—6531)

**CESIUM 137**

**Tissue Distribution**
Dynamics of Cs-137 distribution in the muscle tissue of swine by single and repeated contamination, 7:1202

**CESIUM CHLORIDES**

**Crystal Models**
Deformable shell model study of the properties of CsCl, 7:733

**Crystal-Phase Transformations**
Deformable shell model study of the properties of CsCl, 7:733

**CESIUM IODIDES**

**Corrosive Effects**
Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys, 7:683

**CESIUM IONS**

**Ion Emission**
Enhanced negative secondary ion emission with cesium ion bombardment, 7:685

**CESIUM NITRATES**

**Enthalpy**
Heat capacity from 5 to 350 K and thermodynamic properties of cesium nitrate to 725 K, 7:813

**Formation Free Enthalpy**
Heat capacity from 5 to 350 K and thermodynamic properties of cesium nitrate to 725 K, 7:813

**Formation Heat**
Heat capacity from 5 to 350 K and thermodynamic properties of cesium nitrate to 725 K, 7:813

**Free Enthalpy**
Heat capacity from 5 to 350 K and thermodynamic properties of cesium nitrate to 725 K, 7:813

**Specific Heat**
Heat capacity from 5 to 350 K and thermodynamic properties of cesium nitrate to 725 K, 7:813

**CESIUM URANATES**

**Enthalpy**
Investigations on caesium uranates: VII. Thermochemical properties of $Cs_2U_4O_{12}$, 7:848

**Phase Diagrams**
Investigations on caesium uranates: VII. Thermochemical properties of $Cs_2U_4O_{12}$, 7:848

**Specific Heat**
Investigations on caesium uranates: VII. Thermochemical properties of $Cs_2U_4O_{12}$, 7:848

**CHALCOGENIDES**
*See also OXIDES*

**Recombination**
Recombination in narrow-gapped semiconductors, 7:712 (INIS-mf—6449)

**CHALK RIVER NUCLEAR LABS**

**Hot Cells**
Renovations of beta-gamma hot cells for materials studies at CRNL, 7:863

**CHAPELCROSS-1 REACTOR**

**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369

**CHAPELCROSS-2 REACTOR**

**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369

**CHAPELCROSS-3 REACTOR**

**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369

**CHAPELCROSS-4 REACTOR**

**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369

**CHARGED CURRENTS**

**Structure Functions**
Discussion of the CDHS charged current results, 7:1538

**CHARGED PARTICLES**
*See also TRITONS*

**Elastic Scattering**
Definition of absolute differential cross sections in the case of using many-component targets, 7:1620 (KFTI—79-40)
**CHARGED-PARTICLE ACTIVATION**
*See ACTIVATION ANALYSIS*
*CHARGED PARTICLES*
**CHARMONIUM**
**Quantum Mechanics**
Relativistic potential model of charmonium, 7:1544
**CHEMICAL DOSEMETERS**
**Gamma Dosimetry**
Ceric dosimetry in radiation biology, 7:934 (INIS-mf—6531)
**Performance**
Ceric dosimetry in radiation biology, 7:934 (INIS-mf—6531)
**CHEMICAL HEAT PUMPS**
**Thermochemical Processes**
Application of reversible chemical reactions to solar thermal energy systems, 7:270
**CHEMICAL INDUSTRY**
**Meetings**
Chemeca 80: process industries in the 80's. Proceedings of the eighth Australian Chemical Engineering conference, August 24-27, 1980, 7:158
**CHEMICAL REACTION KINETICS**
Calculability of multiple chemical interactions, 7:818
**CHEMICAL REACTIONS**
*See also DENITRIFICATION*
*DESULFURIZATION*
*FRIEDEL-CRAFTS REACTION*
**Equilibrium**
Calculability of multiple chemical interactions, 7:818
**CHEMOTHERAPY**
**Side Effects**
Analysis of chromosomal aberrations of leukocytes of peripheric blood in patients with depression of different genesis hematopoiesis, 7:1219
**CHERENKOV COUNTING**
Specific counting techniques. Chapter 3. Section 5, 7:752
**CHINA**
**Radiation Monitoring**
Monitoring of environmental radon-222 in selected areas of Taiwan Province of the Republic of China, 7:994
**Uranium Deposits**
Present exploration status of the Lianshanguan uranium deposit, Northeast China, 7:134
**CHINESE HAMSTER**
*See HAMSTERS*
**CHLORIDES**
**Environmental Transport**
Groundwater pollution considered as a continuous injection of tracers, 7:1035
**Mass Spectroscopy**
Mass spectrometric isotope dilution analysis of trace amounts of halides, 7:765
**CHLORINE**
**Quantitative Chemical Analysis**
Beryllium analysis. Chlorine turbidimetric determination, 7:796 (CEA-CETAMA—7)
**CHLORINE LOGS**
*See NEUTRON-GAMMA LOGGING*
**CHOLECALCIFEROL**
**Dynamic Function Studies**
Enterohepatic physiology of 1.25-dihydroxyvitamin D in normal man, 7:1073
Pituitary hormone effects on $^{45}Ca$ release from fetal rat bones, 7:1072
**Metabolism**
Nuclear concentration of $^{3}H$-1.25$(OH)_2$ vitamin D3 in cells of pancreatic islets, 7:1071
Photoproduction in skin of 1α,25-dihydroxyvitamin $D_3$: a novel approach to therapy of vitamin-D-resistant syndromes, 7:1173
Postoperative hypoparathyroidism followed by Parkinsonism, 7:1174
**CHONDRITES**
**Isotope Ratio**
SIMS measurements of magnesium isotopic abundance ratio in the Allende carbonaceous chondrite, 7:1289
**CHROMIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Ion Collisions**
Kβ/Kα intensity ratios and energy shifts of Kβ rays produced by N-ion impact, 7:1399
**Phase Diagrams**
Phase equilibria in the uranium-chromium-carbon system, 7:671
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**Tetragonal Lattices**
Phase equilibria in the uranium-chromium-carbon system, 7:671
**CHROMIUM ALLOYS**
*See also CHROMIUM-NICKEL STEELS*
*NICKEL-CHROMIUM STEELS*
**Corrosion**
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**Phase Stability**
Effect of small fourth-element alloying additions on the calculated phase stability in the Fe-Cr-Ni system, 7:672
**CHROMIUM COMPLEXES**
**Solubility**
Aqueous complexes of metal ions present in the reprocessing of nuclear fuels. Complexes with the ligands orthophenanthroline and dibutyl phosphate, 7:850
**CHROMIUM-MOLYBDENUM STEELS**
**Corrosion**
Effect of liquid sodium on behaviour of selected structural materials for steam generators of fast power reactors, 7:648 (INIS-mf—6423)
**Fatigue**
Effect of biaxial loading and geometry on prediction of low-cycle fatigue life, 7:698
High cycle fatigue of 2.25Cr-1Mo steel at elevated temperatures, 7:662
**CHROMIUM-NICKEL STEELS**
*(Steels containing Cr and Ni; the Ni content is usually 0.5 to 2.0%, the Cr content is higher.)*
**Creep**
Results of study in long-term properties of austenitic steels in liquid sodium, 7:649 (INIS-mf—6423)
**Crystal-Phase Transformations**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**Fatigue**
Effect of biaxial loading and geometry on prediction of low-cycle fatigue life, 7:698
**Physical Radiation Effects**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**CHROMODYNAMICS**
*See QUANTUM CHROMODYNAMICS*
**CHROMOSOMAL ABERRATIONS**
**Biological Radiation Effects**
Yield of sister unions as a function of x-ray dose, 7:1151 (INIS-mf—6531)
**Response Modifying Factors**
Effect of complex preparations on C and P vitamins on the chromosomal aberration formation in hepatocytes of the irradiated rats, 7:1227
**CHROMOSOMES**
**Biological Radiation Effects**
Evidence for an indirect effect of radiation on mammalian chromosomes, 7:1146 (INIS-mf—6531)
**Genetic Mapping**
Protein constraints induced by multiframe encoding, 7:1069

**CIR REACTOR**
*See CIRUS REACTOR*
**CIRENE REACTOR**
**Pressure Tubes**
Simulation of the dynamic loads and stresses due to explosive rupture of a pressure tube in a scaled down model of the CIRENE reactor structure, 7:390
**CIRUS REACTOR**
**Fuel Rods**
Inpile irradiations for verification of pellet clad interaction predictions, 7:497 (IWGFPT—8)
**CLAYS**
*See also MONTMORILLONITE*
**Activation Analysis**
Applications to archaeology. Chapter 5. Section 5, 7:759
**Isotope Ratio**
$^{234}U/^{238}U$ activity ratios in clay as a function of distance from primary ore, 7:132
**Sorptive Properties**
Role of clay adsorption in genesis of uranium ores, 7:83
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**CLEAN AIR ACT**
**Implementation**
Bubble concept: an examination of two applications in the utility industry, 7:1000
**COAL**
*See also ANTHRACITE*
*BLACK COAL*
**Chemical Composition**
Mass spectrometric determination of lead isotopes in West German pit coal, 7:1
**Research Programs**
CSIRO coal research, with emphasis on mining, 7:7
**COAL DEPOSITS**
**Gamma-Gamma Logging**
Results obtained by efficient nuclear logging methods in brown coal deposit exploration in the North Bohemian Brown Coal Basin, 7:2 (INIS-mf—6422)
**Resource Assessment**
CSIRO coal research, with emphasis on mining, 7:7
**COAL MINES**
**Dusts**
Mine demonstrations of longwall dust-control techniques. Phase I status report, 7:4 (BCR-L—1245)
**Environmental Impacts**
Air-quality impacts from Western Surface-coal-mining operations, 7:999
**Gamma-Gamma Logging**
Application of gamma-gamma logging method in the prognosis of anomalous geodynamic effects in hard coal mines, 7:11 (INIS-mf—6422)
Results of a study in stress manifestations in OKR mines by the gamma-gammametric method, 7:12 (INIS-mf—6422)
**Stresses**
Results of a study in stress manifestations in OKR mines by the gamma-gammametric method, 7:12 (INIS-mf—6422)
**COAL MINING**
*See also SURFACE MINING*
*UNDERGROUND MINING*
**Research Programs**
CSIRO coal research, with emphasis on mining, 7:7
**COAL SEAMS**
**Degassing**
Drainage of methane from the solid at West Cliff Colliery. Part 1. Optimization of drainage hole design parameters, 7:8
**COASTAL WATERS**
**Contamination**
Fate of major radionuclides in the liquid wastes released to coastal waters, 7:1047
**Geology**
Geology of the Cardigan Bay-St. George's Channel Basin, 7:49
**Petroleum Deposits**
Geology of the Cardigan Bay-St. George's Channel Basin, 7:49
**Radioecology**
Studies of concentration and transfer factors of natural and artificial actinide elements in a marine environment, 7:1048
**Seismic Surveys**
Geology of the Cardigan Bay-St. George's Channel Basin, 7:49
**COATED FUEL PARTICLES**
**Failures**
Statistical methods for predicting failure probability of coated particles, 7:170
**Gas Analysis**
Gas content measurements of irradiated coated particles using the PGA system, 7:747
**Performance**
Irradiation performance assessment of coated particle fuels using the IMGA system, 7:349
**Performance Testing**
Stress performance calculations as a guide for layout and testing of coated fuel particles for HTRs, 7:171
**Post-Irradiation Examination**
Determination of end-of-life failure fraction of HTGR-fuel particles by post-irradiation annealing and beta-autoradiography, 7:352
New and improved post-irradiation techniques for examination of fission products and actinides in coated particles, 7:348
**Stress Analysis**
Experimental verification of stress model calculations for HTR fuel particles, 7:169
Stress performance calculations as a guide for layout and testing of coated fuel particles for HTRs, 7:171
**COATINGS**
*See also PAINTS*
**Optical Properties**
Composite film selective-absorbers, 7:267
**COBALT**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**Ion Collisions**
$K\beta/K\alpha$ intensity ratios and energy shifts of $K\beta$ rays produced by N-ion impact, 7:1399
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**COBALT 57**
**Leaching**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209
**COBALT 60**
**Environmental Transport**
Mobility and retention of $^{60}Co$ in soils in coastal areas, 7:1046
**COLD PLASMA**
**Electric Fields**
Collision dominated final periodic state of the electron ensemble and its adjustment in a periodic electric field, 7:1468
Transition to quasistationary electron energy distribution after application of electric field, 7:1467
**Equations of Motion**
Computer simulation of ion trajectories, 7:1473
**Kinetics**
Computer simulation of equilibrium and kinetic properties of ionic and plasma clusters, 7:1474
**Maxwell Equations**
Nonstationary signal transition in linearized plasmas, 7:1475
**COLLAGEN**
**Morphological Changes**
Molecular and endocrine mechanisms of postradiation changes in reactivity of bone tissues, 7:1211
**COLLECTRONS**
*See SELF-POWERED NEUTRON DETECTORS*
**COLLIERIES**
*See COAL MINES*

**COLOR MODEL**
**Postulated Particles**
Colour isomers in multiquark systems, 7:1517
**COLORADO**
**Uranium Deposits**
Geology of uranium vein deposits (including Schwartzwalder Mine) in Proterozoic metamorphic rocks, Front Range, Colorado, 7:93
**COLORADO PLATEAU**
**Uranium Deposits**
Effects of ground-water flow on the origin of Colorado Plateau-type uranium deposits, 7:105
**COLUMBIUM**
*See NIOBIUM*
**COMBUSTION PRODUCTS**
**Health Hazards**
Impact of residential wood combustion on urban air quality: first ambient measurements, 7:982
**Plasma Diagnostics**
Electron and positive-ion measurements in MHD combustion plasmas with phosphorous addition (Ethanol fuel), 7:634
**COMPOSITE MATERIALS**
**Optical Properties**
Composite film selective-absorbers, 7:267
**COMPOUND NUCLEI**
**Shell Models**
Multi-centre shell model, 7:1631
**COMPOUNDS (ORGANIC)**
*See ORGANIC COMPOUNDS*
**COMPUTER CODES**
**A Codes**
Study of devices for the non destructive examination of drums containing low activity waste by neutron transport and gamma radiation codes (APPOLO), 7:236 (EUR—6629)
**B Codes**
BACO fuel rod analysis computer program, 7:384
**C Codes**
Computerisation of the γ-spectrometric method for fission yield measurement based on GAMANAL program (CLSQ code), 7:942 (ZfK—410)
**F Codes**
FWLTB - a computer program for predicting the lifetime of a fusion reactor first wall, 7:1695
UNIBUS processor interface for a FASTBUS data acquisition system, 7:914
**G Codes**
Computerisation of the γ-spectrometric method for fission yield measurement based on GAMANAL program (CLSQ code), 7:942 (ZfK—410)
**I Codes**
Many channel spectrum unfolding, 7:435 (EUR—6813(Vol.2))
**M Codes**
MABEL-2. A code to analyze cladding deformation in a loss-of-coolant accident: status, 7:552 (IWGFPT—7)
**N Codes**
Computer program system for structural design of nuclear power plants, 7:576
**P Codes**
Progress with the probabilistic fuel failure code POSHO, 7:486 (IWGFPT—7)
**S Codes**
Analysis and extension of the SAND-II code, 7:433 (EUR—6813(Vol.2))
Analysis of colliding vibration of two cylinders, 7:460
Few-channel unfolding in shielding - the SENSAK code, 7:1638 (EUR—6813(Vol.2))
Unfolding by least-squares methods: SAND-II, STAY'SL, 7:434 (EUR—6813(Vol.2))
**CONCENTRATING COLLECTORS**
**Solar Reflectors**
Solar mirror materials: their properties and uses in solar concentrating collectors, 7:263
**CONCENTRATOR SOLAR CELLS**
Research and device problems in photovoltaics, 7:254
**Efficiency**
High efficiency silicon cells for luminescent solar concentrators, 7:250
**Luminescent Concentrators**
High efficiency silicon cells for luminescent solar concentrators, 7:250
**CONCRETES**
*See also PRESTRESSED CONCRETE*
*REINFORCED CONCRETE*
**Chemical Reaction Kinetics**
Influence of gas generation on melt/concrete interactions, 7:561
**Comparative Evaluations**
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
**Creep**
Concrete for PCRV's: Mechanical properties at elevated temperatures and residual mechanical behaviour after triaxial preloading, 7:738
**Fluid-Structure Interactions**
Interaction of molten 'corium' with concrete in a hypothetical LWR core-melt-down accident. Oxidation of core materials and hydrogen production, 7:562
**Sorptive Properties**
Diffusion of cesium in concrete, 7:210
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**Stresses**
Ultimate strength criteria of concrete under bi-axial and tri-axial loading, 7:739
**CONNECTICUT YANKEE REACTOR**
**Fuel Element Failure**
Review of the fuel failures in batch 8 fuel from the Haddam Neck Reactor, 7:303 (IWGFPT—8)
**CONSERVATION (ENERGY)**
*See ENERGY CONSERVATION*
**CONSERVATION (RESOURCE)**
*See RESOURCE CONSERVATION*
**CONTAINERS**
*See also CALANDRIAS*
*CASKS*
*PRESSURE VESSELS*
**Evaluation**
Assessment of the containment of the UK 250 litre plutonium nitrate package, 7:855 (INIS-mf—6447)
**Leak Testing**
Importance of leak flow mode assumptions for interpretation of package leaktightness tests and influence of test conditions on conclusions, 7:853 (INIS-mf—6447)
Leak testing and activity leakage rate evaluation. Practical experiences, first approaches to some systemization and outstanding problems, 7:854 (INIS-mf—6447)
**CONTAINMENT**
*(Means and methods for preventing the escape of fission products to the atmosphere, particularly in the case of reactor accidents.)*
*See also CONTAINMENT BUILDINGS*
*CONTAINMENT SHELLS*
*CONTAINMENT SYSTEMS*
**Oscillations**
Unconventional dynamic behaviour of thin spherical containment shells. A semi-analytical description, 7:600
**CONTAINMENT BUILDINGS**
**Design**
Computer program system for structural design of nuclear power plants, 7:576
**Impact Shock**
Comparison of response spectra for aircraft impact calculated by a beam-mode and a 3D-shell-model, 7:586
**Liners**
Analysis and design of containment liner/anchorage system, 7:330
**Missile Protection**
Mechanistic assessment of structural failure for missile impacts on concrete structures, 7:393
**Performance Testing**
Performance of Scandinavian BWR-containments during pressure tests, 7:572
**Seismic Effects**
Coupled lateral-torsional response of equipment mounted in CANDU nuclear power plants, 7:595
Integrated structural design of nuclear power plants for high seismic areas, 7:587

Nonlinear analysis of a BWR reactor building subjected to both thermal and earthquake loadings, 7:574
Seismic response comparisons for an embedded high temperature gas-cooled reactor (HTGR) on a high seismic site, 7:592
Soil structure interaction analysis by different methods, 7:589
Structure-to-structure interaction analysis for a nuclear power plant, 7:573
**Stress Analysis**
Mechanistic assessment of structural failure for missile impacts on concrete structures, 7:393
**Thermal Stresses**
Nonlinear analysis of a BWR reactor building subjected to both thermal and earthquake loadings, 7:574
**CONTAINMENT SHELLS**
**Failures**
Test of a model of a thin-walled prestressed concrete secondary containment structure, 7:388
**Leak Testing**
Experimental study of a spherical PWR-containment with geometrical imperfections at the welds, 7:318
**Stress Analysis**
Behaviour of concrete containment under over-pressure conditions, 7:386
Elasto-plastic analysis of nozzle intersections in reactor containments, 7:319
**Stresses**
Results of strength tests on a 1:10 model of reactor containment, 7:317
**Tensile Properties**
Modelling and predicting behavior of prestressed concrete secondary containment structures using BOSOR 5, 7:387
**CONTAINMENT SYSTEMS**
**Construction**
Design and construction of the prestressed concrete containments of the French standard 900 MWe PWR, 7:316
**Design**
Design and construction of the prestressed concrete containments of the French standard 900 MWe PWR, 7:316
**Specifications**
Basic design requirements for the containment system of a mixed oxide fuel fabrication plant, 7:168
**Stress Analysis**
Super element model development and analysis on the Mark I torus structure, 7:577
**CONTAMINATION (INTERNAL)**
*See RADIONUCLIDE KINETICS*
**CONTINENTAL CRUST**
**Mapping**
Nature of the continental crust beneath Britian, 7:1248
**Seismic Surveys**
Nature of the continental crust beneath Britian, 7:1248
**CONTINENTAL MARGIN**
**Age Estimation**
Age and nature of the crystalline basement of the North Sea Basin, 7:15
**Bathymetry**
Continental margin from the Porcupine Seabight to the Armorican marginal basin, 7:51
**Geologic History**
Age and nature of the crystalline basement of the North Sea Basin, 7:15
Continental margin from the Porcupine Seabight to the Armorican marginal basin, 7:51
**Gravity Surveys**
Regional interpretation of North Sea gravity data, 7:16
**Mapping**
Regional interpretation of North Sea gravity data, 7:16
**Petroleum Deposits**
Continental margin from the Porcupine Seabight to the Armorican marginal basin, 7:51
Structure and stratigraphy of the Kish Bank Basin, 7:48
**Stratigraphy**
Structure and stratigraphy of the Kish Bank Basin, 7:48
**CONTINENTAL SHELF**
**Bathymetry**
Geology of the Barents Sea, 7:45
**Geologic Faults**
Structural framework of the central and northern North Sea, 7:19
**Geologic History**
Caledonides: their influence on the stratigraphy of the Northwest European continental shelf, 7:18
Evolution of sedimentary basins in northwest Europe, 7:14
Fastnet Basin: an integrated analysis, 7:50
Geology of the Norwegian Shelf between 62°N and the Lofoten Islands, 7:46
Mid-Cretaceous palaeontology and stratigraphy, central North Sea, 7:32
Regional seismic structure maps of the North Sea, 7:17
Sole pit inversion tectonics, 7:21
Tectonic significance of post-Carboniferous igneous activity in the North Sea Basin, 7:22
**Geology**
Basin development and sedimentation in the Middle Jurassic of the northern North Sea, 7:28
Geology of the Norwegian Shelf between 62°N and the Lofoten Islands, 7:46
Geology of the Morecambe gas field, 7:56
**Geophysical Surveys**
Geology of the Barents Sea, 7:45
**Geothermal Gradients**
Geothermal gradients of the Northern North Sea Basin, 59 to 62°N, 7:24
**Maps**
Regional seismic structure maps of the North Sea, 7:17
**Natural Gas Deposits**
Integration of palynological and sedimentological methods in facies analysis of the Brent Formation, 7:29
Oils and source rocks of the North Sea area, 7:25
Zechstein facies and petroleum prospects in the central and northern North Sea, 7:26
**Natural Gas Fields**
Frigg gas field, 7:55
Geological input to reservoir simulation of the Brent Formation, 7:37
Geology of the Morecambe gas field, 7:56
Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland, 7:57
Petroleum geology of the continental shelf of northwest Europe, 7:13
Rotliegend gas fields of the K and L blocks, Netherlands Offshore (1968 to 1978): a case history, 7:54
**Oil Fields**
Brae oilfield area, 7:42
Geological input to reservoir simulation of the Brent Formation, 7:37
Geology of the Magnus oilfield, 7:41
Heather oil field, 7:40
Petroleum geology of the continental shelf of northwest Europe, 7:13
Piper oilfield, 7:43
Reservoir geological model of the Brent Sands in southern Cormorant, 7:39
Reservoir geology of the Forties oilfield, 7:44
**Oil Wells**
Piper oilfield, 7:43
Reservoir geology of the Forties oilfield, 7:44
**Petroleum Deposits**
Fastnet Basin: an integrated analysis, 7:50
Integration of palynological and sedimentological methods in facies analysis of the Brent Formation, 7:29
Oils and source rocks of the North Sea area, 7:25
Petroleum geology west of the Shetlands, 7:47
Zechstein facies and petroleum prospects in the central and northern North Sea, 7:26
**Petroleum Geology**
Petroleum geology west of the Shetlands, 7:47
**Reservoir Rock**
Middle Jurassic North Sea Deltas with particular reference to Yorkshire, 7:27
Oils and source rocks of the North Sea area, 7:25
Zechstein facies and petroleum prospects in the central and northern North Sea, 7:26

**Seismic Surveys**
Northern North Sea Jurassic unconformities, chronostratigraphy and sea-level changes from seismic stratigraphy, 7:30
**Stratigraphy**
Basin development and sedimentation in the Middle Jurassic of the northern North Sea, 7:28
Caledonides: their influence on the stratigraphy of the Northwest European continental shelf, 7:18
Northern North Sea Jurassic unconformities, chronostratigraphy and sea-level changes from seismic stratigraphy, 7:30
Petroleum geology of the continental shelf of northwest Europe, 7:13
Seismic stratigraphy of the North Sea Palaeocene deposits, 7:33
Stratigraphical relationships of Palaeocene sands in the UK sector of the central North Sea, 7:34
Structural evolution of the North Viking Graben, 7:20
Subcrop of the Mid-Mesozoic unconformity in the UK area, 7:31
**Tectonics**
Basin development and sedimentation in the Middle Jurassic of the northern North Sea, 7:28
Sole pit inversion tectonics, 7:21
Structural framework of the central and northern North Sea, 7:19
Subcrop of the Mid-Mesozoic unconformity in the UK area, 7:31
Tectonic significance of post-Carboniferous igneous activity in the North Sea Basin, 7:22
**Temperature Logging**
Geothermal gradients of the Northern North Sea Basin, 59 to 62°N, 7:24
Temperature, thermal gradients and heat flow in the southwestern North Sea, 7:23
**CONTROL THEORY (REACTOR)**
*See REACTOR KINETICS*
**COOLANTS**
*(See also specific coolant materials.)*
**Chemical Composition**
Methanation of carbon dioxide over a ruthenium catalyst for AGR gas circuit composition control, 7:248
Trace organics in AGR coolants, 7:367
**COOLERS**
*See HEAT EXCHANGERS*
**COOPER REACTOR**
**Environmental Impacts**
Mixing zone analysis for river plumes, 7:281
**Open-Cycle Cooling Systems**
Mixing zone analysis for river plumes, 7:281
**Thermal Effluents**
Mixing zone analysis for river plumes, 7:281
**COPPER**
**Absorption Spectroscopy**
Stable product low leach glasses, 7:202
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Ion Collisions**
K, L and M shell ionizations in the energy region E/lambda U > 1, 7:1400
Kβ/Kα intensity ratios and energy shifts of Kβ rays produced by N-ion impact, 7:1399
**Leaching**
Stable product low leach glasses, 7:202
**Spectrophotometry**
Analysis of uranium and of some of its compounds and alloys. Copper spectrophotometric determination, 7:798 (CEA-CETAMA—7)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**Toxicity**
Influence of organic chelators on the toxicity of copper to embryos of the Pacific oyster, Crassostrea gigas, 7:1247
**COPPER 63 TARGET**
**Photonuclear Reactions**
Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV, 7:1576 (KFTI—80-6)
**COPPER ALLOYS**
*See also COPPER BASE ALLOYS*
**Corrosion**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**COPPER BASE ALLOYS**
**Specific Heat**
Crystal dynamics and specific heat of copper doped alloys, 7:688
**COPPER IODIDES**
**Lattice Vibrations**
Shortrange three-body interaction and the lattice statics and dynamics of CuI crystal, 7:734
**COPPER IONS**
**Penning Ion Sources**
Multiply charged ion beams of solids from sputter duoPIGatrons, 7:1389
**COPPER ORES**
**By-Products**
Potential by-product uranium production in the United States of America, 7:157
**CORDOBA REACTOR**
**Construction**
Design and construction progress on Gentilly 2, Cordoba, Point Lepreau, and Wolsung projects, 7:382
**CORE FLOODING SYSTEMS**
**Performance**
RELAP4/MOD6 reflood heat transfer and data comparison, 7:558
**CORIUM**
**Fluid-Structure Interactions**
Interaction of molten 'corium' with concrete in a hypothetical LWR core-melt-down accident. Oxidation of core materials and hydrogen production, 7:562
**CORN (MAIZE)**
*See MAIZE*
**CORONA (SOLAR)**
*See SOLAR CORONA*
**CORROSION PRODUCTS**
**Activation Analysis**
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**CORTEX (ADRENAL)**
*See ADRENAL GLANDS*
**CORTICOIDS**
*See CORTICOSTEROIDS*
**CORTICOSTEROIDS**
**Dynamic Function Studies**
Corticosteroid-induced changes in fluxes and in intracellular distribution of calcium in cultured bone cells, 7:1074
**CORTISOL**
*See HYDROCORTISONE*
**COSMIC DUST**
**Hydrogen**
Observation of dust generated hydrogen in the solar vicinity, 7:1311
**COSMIC GAMMA SOURCES**
**Gamma Spectra**
Balloon observation of galactic gamma-ray lines, 7:1368
**COSMIC GASES**
**Desorption**
Observation of dust generated hydrogen in the solar vicinity, 7:1311
**COSMIC PARTICLES**
*See COSMIC RADIATION*
**COSMIC RADIATION**
**Annual Variations**
Long-period variations of cosmic rays in the stratosphere, 7:1382 (INIS-mf—6290)

**Electrical Properties**
Electromagnetic properties of a cosmic ray gas and diamagnetism of solar cosmic rays in magnetic traps, 7:1280 (INIS-mf—6385)
**Energy Transfer**
Energy exchange between cosmic rays and the solar wind, 7:1281 (INIS-mf—6385)
**Forbush Decrease**
Structure of Forbush decreases during geomagnetic storm development with sudden commencement according to observations in the Arti observatory during 1978, 7:1279 (INIS-mf—6290)
Variations of interplanetary parameters and cosmic-ray intensities, 7:1349
**Magnetic Properties**
Electromagnetic properties of a cosmic ray gas and diamagnetism of solar cosmic rays in magnetic traps, 7:1280 (INIS-mf—6385)

**COSMIC RAY DETECTION**
Application of solid state track detector to detect heavy primary cosmic ray, 7:936 (KURRI-TR—190)

**COSMIC RAY FLUX**
**Energy Spectra**
Definition of solar cosmic ray energy spectra in a source, 7:1277 (INIS-mf—6290)

**COSMIC X-RAY SOURCES**
**X-Ray Detection**
Observation of soft x-ray and hard x-ray by the satellite Hakucho, 7:1371
Observation of super-soft x-ray by the satellite 'Hakucho', 7:1372

**COUNTERS (RADIATION)**
*See RADIATION DETECTORS*

**COUNTING TECHNIQUES**
*See also CHERENKOV COUNTING*
*PHOTOELECTRON COUNTING*
Etching conditions and shape of tracks. Continuous etching with HF of 5, 10, 20 and 46%, 7:938 (KURRI-TR—190)

**COVER GAS**
*(Nonreactive gas covering the sodium coolant in a reactor vessel.)*
**Decontamination**
Performance of a cryogenic distillation system for purifying the argon cover gas in a fast reactor, 7:427
**Quantitative Chemical Analysis**
Mass spectrometric analysis of gaseous samples, 7:784

**CREEKS**
*See RIVERS*

**CRIME DETECTION**
**Multi-Element Analysis**
Forensic applications. Chapter 5. Section 6, 7:760
**X-Ray Emission Analysis**
Studies of forensic related trace elemental problems by the particle induced X-ray emission (PIXE) method, 7:777

**CRITICALITY ACCIDENTS**
*See RADIATION ACCIDENTS*

**CROSS SECTIONS**
**Benchmarks**
Analysis of the Winfrith iron benchmark experiment with DUCKPOND and comparison with the ANISN/SWANLAKE analysis, 7:440
**Computerized Simulation**
Iterative multigroup cross-section adjustment procedure, 7:452
**Quasi-Elastic Scattering**
Electron quasi-free scattering by atomic nuclei in the interaction time approximation, 7:1560 (KFTI—79-48)

**CRUDE OIL**
*See PETROLEUM*

**CRYOSTATS**
**Fabrication**
Design and fabrication of a high homogeneity high field superconducting magnet, a metal cryostat and a high stability energiser, 7:1660

**CRYSTAL DEFECTS**
Introduction to the role of crystal defects in solar materials, 7:641
**Computer Calculations**
Defect modelling, 7:647 (AERE-TP—843)

**CRYSTAL LATTICES**
*See also CUBIC LATTICES*
**Instability**
Instability zones of interacting point defects in the periodical structures, 7:1651 (KFTI—79-65)

**CUBIC LATTICES**
**Dispersion Relations**
Phonon modes in a disordered lattice, 7:1652

**CURIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Ion-Atom Collisions**
Positron production in heavy ion collisions, 7:1411
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**CURIUM 244**
**Biological Radiation Effects**
Biological effects of inhaled radionuclides. Summary of ICRP report 31, 7:1184

**CURIUM 248 TARGET**
**Uranium 238 Reactions**
Fission properties of very heavy nuclei produced in deep-inelastic collisions, 7:1603

**CYANOCOBALAMIN**
*See VITAMIN B-12*

**CYCLIC ADENOSINE MONOPHOSPHATE**
*See AMP*

**CYLINDERS**
**Creep**
Creep buckling and instability of circular cylindrical shells in axial compression, 7:468
Creep collapse of a cylindrical shell subjected to external pressure at high temperature, 7:599
**Failures**
Creep collapse of a cylindrical shell subjected to external pressure at high temperature, 7:599

**CYPRUS**
**Ground Water**
Geochemical and isotopic approach to recharge evaluation in semi-arid zones: past and present, 7:1014

**CYSTEAMINE**
*See MEA*

**CYSTEINE**
**Dissolution**
Sustained release of radioprotective agents in vitro, 7:1199

**CZECHOSLOVAKIA**
**Nuclear Power Plants**
Aspects of design integrity for preparation of rules and standards for nuclear power plants in the Czechoslovak Socialist Republic, 7:312

## D

**D REGION**
**Noctilucent Clouds**
Positive ion composition in noctilucent clouds, 7:1374 (ESA-SP—152)

**D RESONANCES**
**Particle Production**
D-meson inclusive production in $e^+e^-$ annihilation, 7:1519
Production of D- and PSI-mesons in hadron interactions, 7:1520

**DAMS**
**Geological Surveys**
Radiometric survey of water dam areas in the Beskydy Mountains, 7:249 (INIS-mf—6422)
**Liquid Flow**
Radiotracer monitoring of water flow in dams, 7:1032 (INIS-mf—6422)

**Radiometric Surveys**
Radiometric survey of water dam areas in the Beskydy Mountains, 7:249 (INIS-mf—6422)

**DANUBE RIVER**
**Radiation Monitoring**
General report on radioecological studies and radioactivity monitoring measurements of the Danube River, 7:1044 (IAEA-TECDOC—229)
**Radioactivity**
Application of the concept of collective dose commitment in environmental monitoring selection of significant radionuclides, 7:1041 (IAEA-TECDOC—229)
Radionuclide accumulation in selected components of the aquatic fauna of the Czechoslovak Danube River section, 7:1042 (IAEA-TECDOC—229)
**Radioecology**
Chemical behaviour and ecological transfer in the human food chain of some radionuclides in aqueous ecosystems, 7:1043 (IAEA-TECDOC—229)
General report on radioecological studies and radioactivity monitoring measurements of the Danube River, 7:1044 (IAEA-TECDOC—229)
Methodology used for the study of sorption properties of bottom sediments and some basic information on the behaviour of selected radionuclides in aqueous media, 7:1036 (IAEA-TECDOC—229)
Radioactive contamination of the Soviet part of the mouth of the Danube and the adjacent area of the Black Sea in 1976-78, 7:1039 (IAEA-TECDOC—229)
Radiological analysis of the river system of the upper Danube, 7:1037 (IAEA-TECDOC—229)
Study on the problems of the radioecology of the river Danube, 7:1038 (IAEA-TECDOC—229)

**DATA ACQUISITION SYSTEMS**
*See also CAMAC SYSTEM*
Distributed systems in the heavy water plant environment, 7:244 (AECL—7056)
LLNL nuclear chemistry automated production counting facilities: design and implementation, 7:1708
**Equipment Interfaces**
UNIBUS processor interface for a FASTBUS data acquisition system, 7:914

**DDT**
*(Dichlorodiphenyltrichloroethane.)*
**Synergism**
Neoplasm appearance resulting from chronic intake of mixtures of radium-226, strontium 90, ddt, 7:1233

**DECAY**
**Computer Codes**
Computer code for nuclear decay scheme construction, 7:1555 (INIS-mf—6479)

**DECONTAMINATION**
Choice of the method and reagents for maintenance washing and decontamination of the NPP equipment, 7:470

**DEEP INELASTIC SCATTERING**
**Quantum Chromodynamics**
Constraints on nucleon quark models from deep inelastic scattering data, 7:1552 (IPNO-TH—80-49)

**DEFORMED NUCLEI**
**Energy-Level Transitions**
Collective bands of positive parity states in (FP) shell nuclei, 7:1586

**DEGRADATION (NUCLEAR)**
*See DECAY*

**DENITRIFICATION**
**Electron Beams**
Removal of SOx and NOx from flue gases by electron radiation, 7:984

**DENSIMETERS**
**Performance**
Radiometric determination of bulk density of suspensions by the absorption method, 7:972 (INIS-mf—6422)

**DENSITY (ENERGY-LEVEL)**
*See ENERGY-LEVEL DENSITY*

**DENSITY LOG**
*See GAMMA-GAMMA LOGGING*

**DEOXYPENTOSE NUCLEIC ACID**
*See DNA*

**DEOXYRIBONUCLEIC ACID**
*See DNA*

**DESERTS**
**Geology**
Isotope investigations as a tool for regional hydrogeological studies in the Libyan Arab Jamahiriya, 7:1020
**Ground Water**
Interpretation of environmental isotopic groundwater data. Arid and semi-arid zones, 7:1013
**Hydrology**
Aspects of the isotope hydrology of two sandstone aquifers in arid Australia, 7:1017
Aspects of the environmental isotope chemistry in groundwaters in Eastern Jordan, 7:1023
Conceptual hydrochemical model for alluvial aquifers on the Saudi Arabian basement shield, 7:1024
Environmental isotopes in North African groundwaters; and the Dahna sand-dune study, Saudi Arabia, 7:1016
Environmental isotope study of groundwater systems in the Republic of Djibouti, 7:1026
Examination of recharge mound decay and fossil gradients in arid regional sedimentary basins, 7:1015
Geochemical and isotopic approach to recharge evaluation in semi-arid zones: past and present, 7:1014
Groundwater flow patterns in the western Libyan Arab Jamahiriya evaluated from isotopic data, 7:1021
Isotope investigations as a tool for regional hydrogeological studies in the Libyan Arab Jamahiriya, 7:1020
Isotope methods as a tool for Quaternary studies in Saudi Arabia, 7:1025
Precipitation, flood- and groundwaters of the Negev Highlands. An isotopic study of desert hydrology, 7:1011
Recharge of groundwaters in arid areas. Case of the Djeffara plain in Tripolitania, Libyan Arab Jamahiriya, 7:1022
Study of the leakage between two aquifers in Hermosillo, Mexico, using environmental isotopes, 7:1018
Use of environmental isotopes in arid zone hydrology, 7:1012
Utilization of natural isotopes in the study of salination of the waters in the Pajeu River Valley, northeast Brazil, 7:1019
**Water**
Water conservation in semiarid dryland agriculture, 7:1130 (IAEA-TECDOC—236)

**DESOXYRIBONUCLEIC ACID**
*See DNA*

**DESULFURIZATION**
**Electron Beams**
Removal of SOx and NOx from flue gases by electron radiation, 7:984
**Environmental Effects**
Sulfur gas emissions from stored flue gas desulfurization sludges, 7:1005
**Sludges**
Sulfur gas emissions from stored flue gas desulfurization sludges, 7:1005

**DETECTORS (RADIATION)**
*See RADIATION DETECTORS*

**DEUTERIUM**
**Isotope Effects**
Secondary isotope effects on alpha-cleavage reactions, 7:826
**Mass Spectroscopy**
Isotopic analysis of water by mass spectrometry, 7:782
Mass spectrometers as an analytical tool in heavy water production, 7:246
Mass spectrometric analysis of deuterium in water, 7:783
Need for accurate deuterium analysis in a heavy water plant and its achievement, 7:245
Study of the instrumental and other aspects in the mass spectrometric analysis of deuterium content, 7:781

**DEUTERIUM COMPOUNDS**
**Sorption**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216

**DEUTERIUM IONS**
**Collisions**
Inner shell ionization in the collision system of $Z_1 << Z_2$, 7:1401
**DEUTERIUM OXIDES**
*See HEAVY WATER*
**DEUTERIUM TARGET**
**Electron Reactions**
Nucleon-nucleon potentials and quasi-free scattering of electrons by deuterons, 7:1559 (KFTI—79-48)
**Photonuclear Reactions**
Meson exchange and the photodisintegration of the deuteron, 7:1567
Polarization effects in the $\gamma d \rightarrow np$ reaction and $D^*$ resonances, 7:1558 (KFTI—79-48)
**Pion Minus Reactions**
Inclusive distributions in double scattering process in $\pi^- d$ interactions at 205 and 360 GeV/c, 7:1493
**Pion Reactions**
Effect of pion absorption on the elastic $\pi d$ scattering, 7:1569 (IPNO-TH—80-49)
**DEUTERON REACTIONS**
**Inelastic Scattering**
Problem of monopole resonance in nuclei, 7:1623 (KFTI—79-48)
**Stripping**
Program for computation of cross section and analyzing power of deuteron stripping in the analog channel threshold by the distorted wave method, 7:1618 (KFTI—79-40)
**DEUTERON-DEUTERON INTERACTIONS**
*See DEUTERIUM TARGET*
*DEUTERON REACTIONS*
**DEVELOPING COUNTRIES**
**Agriculture**
Contribution of the Land and Water Development Division of FAO to soil and water conservation in developing countries, 7:1129 (IAEA-TECDOC—236)
**DFR REACTOR**
**Temperature Monitoring**
Calibration of silicon carbide temperature monitors in a fast reactor, 7:411
**DHDECMP**
**Solvent Properties**
Extraction of Th(IV) and U(VI) by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:745
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**DIAMINOCAPROIC ACID**
*See LYSINE*
**DIAMONDS**
**Bremsstrahlung**
Relativistic electron radiation in diamond monocrystal, 7:1640 (KFTI—79-57)
**Crystal Models**
Potential model for covalent crystals, 7:736
**Electron Channeling**
Relativistic electron radiation in diamond monocrystal, 7:1640 (KFTI—79-57)
**DICHLORODIPHENYLTRICHLOROETHANE**
*See DDT*
**DIELECTRIC TRACK DETECTORS**
Effect of annealing on fission fragment tracks in soda glasses, 7:964
Etch induction time in diacel plastic track detector, 7:966
Etching and annealing behaviour of glass nuclear track detector, 7:963
Etching behaviour of a soda glass detector, 7:965
Passive monitor for radon using electrochemical track etch detector, 7:957
Study of nuclear reactions in high energy using solid state track detectors, 7:913 (KURRI-TR—190)
**Alpha Dosimetry**
Application of solid state track detector as an alpha-ray detector, 7:940 (KURRI-TR—190)
**Cosmic Ray Detection**
Application of solid state track detector to detect heavy primary cosmic ray, 7:936 (KURRI-TR—190)
Possibility of isotope separation in primary cosmic ray using plastic films, 7:962
**Counting Techniques**
Etching conditions and shape of tracks. Continuous etching with HF of 5, 10, 20 and 46%, 7:938 (KURRI-TR—190)
**Neutron Dosimetry**
Application of solid state track detector to neutron dosimetry, 7:939 (KURRI-TR—190)
**Particle Tracks**
Nuclear track production in solids, 7:711
**Performance**
Few applications of solid state track detector to reactor physics experiments, 7:937 (KURRI-TR—190)
**Performance Testing**
Application of solid state track detector as an alpha-ray detector, 7:940 (KURRI-TR—190)
**Personnel Dosimetry**
Application of solid state track detector as an alpha-ray detector, 7:940 (KURRI-TR—190)
**Sensitivity**
Application of solid state track detector to neutron dosimetry, 7:939 (KURRI-TR—190)
Sensitivity enhancement of glass detectors, 7:967
**DIMETHYLBENZENES**
*See XYLENES*
**DIPHENYLKETONE**
*See BENZOPHENONE*
**DISASTERS**
*See ACCIDENTS*
**DISTORTED WAVE BORN APPROXIMATION**
*See DWBA*
**DISTRIBUTED COLLECTOR POWER PLANTS**
**Efficiency**
Heat engine requirements for advanced solar thermal power systems, 7:258
**Specifications**
Heat engine requirements for advanced solar thermal power systems, 7:258
**DISTRIBUTION**
*(For energy distribution see ENERGY SPECTRA.)*
**Calculation Methods**
Simplified method of DNA distribution analysis, 7:1068
**DNA**
*(Deoxyribonucleic acid.)*
**Biological Repair**
R-plasmid mediated repair in Pseudomonas aeruginosa, 7:1155 (INIS-mf—6531)
**Distribution**
Simplified method of DNA distribution analysis, 7:1068
**Transcription**
Transcription termination at the end of the early region of bacteriophage T7 DNA, 7:1070
**DNA REPLICATION**
**Biological Repair**
Are we at risk from low-level radiation. DNA repair capacity as a probe of potential damage and recovery, 7:1180
**DORMITORIES**
*See RESIDENTIAL BUILDINGS*
**DOSEMETERS**
*See also CALORIMETRIC DOSEMETERS*
*CHEMICAL DOSEMETERS*
*RITAC DOSEMETERS*
**Dielectric Track Detectors**
Passive monitor for radon using electrochemical track etch detector, 7:957
**Ionization Chambers**
Calibration of radiation protection instruments at SSDL level in Israel, 7:959
**Surface Barrier Detectors**
Beta dosimetry with surface barrier detectors, 7:958
**DOUNREAY FAST REACTOR**
*See DFR REACTOR*
**DOUNREAY PROTOTYPE FAST REACTOR**
*See PFR REACTOR*

**DRAG EFFECT**
*See ELECTROPHORESIS*
**DRELL MODEL**
**Hadron Reactions**
Drell-Yan process as a test of models for particle production on nuclei, 7:1514
**Pair Production**
Drell-Yan process as a test of models for particle production on nuclei, 7:1514
**DRIFT CHAMBERS**
**Performance**
Multiwire proportional and drift chambers: from first principles to future prospects, 7:941 (RL—80-043)
**Specifications**
Multiwire proportional and drift chambers: from first principles to future prospects, 7:941 (RL—80-043)
**DRILL CORES**
**Neutron Logging**
Integration of palynological and sedimentological methods in facies analysis of the Brent Formation, 7:29
**DRINKING WATER**
**Metabolism**
Iodine-131 application in studying mechanism of Morshin mineral water effect, 7:1083
**Natural Radioactivity**
$^{226}$Ra- and $^{222}$Rn-content of drinking water, 7:1049
**DROSOPHILA**
**Biological Radiation Effects**
Nature of radiation-induced chromosomal interchanges in Drosophila oocytes, 7:1163 (INIS-mf—6531)
**Radiosensitivity**
Catalase and superoxide dismutase levels in radiation resistant strains of D. melanogaster, 7:1162 (INIS-mf—6531)
**DRUGS**
*See also RADIOPROTECTIVE SUBSTANCES*
*RADIOSENSITIZERS*
**Chemical Radiation Effects**
Effect of ionizing radiation sterilization dose on some polysaccharides, 7:836 (INIS-mf—5673)
**DUBNA SYNCHROCYCLOTRON**
**Personnel Dosimetry**
Contribution to neutron dosimetry at the synchrocyclotron at the Joint Institute for Nuclear Research, Dubna, 7:907
**Radiation Monitoring**
Contribution to neutron dosimetry at the synchrocyclotron at the Joint Institute for Nuclear Research, Dubna, 7:907
**DUOPLASMATRONS**
**Heavy Ions**
Pressure dependence and stability of the extracted ion current in arc-discharge-type heavy-ion sources, 7:1396
**Performance**
High-current DC heavy-ion source, 7:1395
Improvement of multiply charged ion production for pulsed duoplasmatron of duoPIGatron, 7:1393
Multiply charged ion beams of solids from sputter duoPIGatrons, 7:1389
Pressure dependence and stability of the extracted ion current in arc-discharge-type heavy-ion sources, 7:1396
Yield of negative ions from the duoplasmatron plasma, 7:1439
**Performance Testing**
Proton source for the high-intensity Lamb-shift-type polarised ion source, 7:1394
**Proton Beams**
Proton source for the high-intensity Lamb-shift-type polarised ion source, 7:1394
**DUSTS**
*See also COSMIC DUST*
**Control**
Mine demonstrations of longwall dust-control techniques. Phase I status report, 7:4 (BCR-L—1245)
**DWBA**
*Distorted Wave Born Approximation.*
**Scattering Amplitudes**
Evaluation of relativistic and nonrelativistic DWBA scattering amplitude using wave functions calculated with the help of Green's function, 7:1630
**DYE LASERS**
Investigation of a high power tunable dye laser, 7:889
**DYSPROSIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**DYSPROSIUM 152**
**High Spin States**
High spin isomeric states in $^{152}$Dy, 7:1592 (INP—1014/PL)

## E

**E-1422 RESONANCES**
**Particle Widths**
Observation of the radiative transition PSI → γE(1420), 7:1489
**Rest Mass**
Observation of the radiative transition PSI → γE(1420), 7:1489
**EARS**
*See AUDITORY ORGANS*
**EARTH ATMOSPHERE**
*See also IONOSPHERE*
*SURFACE AIR*
**Proton Spectra**
Observations of magnetospheric proton fluxes with energy more than 25 KeV in the interplanetary medium in March-April 1977, 7:1383 (INIS-mf—6290)
**EARTHQUAKES**
**Meetings**
Numerical methods for engineering, 7:571
**E-BEAM TYPE REACTORS**
**Hydrodynamics**
Hydrodynamic effects in inertial fusion reactors, 7:1688
**EBIS**
*See ELECTRON BEAM ION SOURCES*
**ECCS**
*(Emergency core cooling system.)*
*See also CORE FLOODING SYSTEMS*
**Hydraulics**
Model of countercurrent steam-water flow in large horizontal pipes (PWR), 7:557
**Two-Phase Flow**
Model of countercurrent steam-water flow in large horizontal pipes (PWR), 7:557
**EDDY CURRENT TESTING**
Recent improvements in facilities for gamma-scanning and other non-destructive examinations of irradiated materials at ECN's hot cell plant L.S.O., 7:873
**Data Acquisition Systems**
Computer based recording and handling of non-destructive PIE data at Risoe, 7:874
**EFR REACTOR**
*See JOYO REACTOR*
**EGYPTIAN ARAB REPUBLIC**
**Agriculture**
Some aspects in relation to the efficient use of soils, water and fertilizers in Egypt, 7:1126 (IAEA-TECDOC—236)
**EINSTEIN FIELD EQUATIONS**
**Analytical Solution**
Non-statical sources of the Taub and Kasner solutions of Einstein equations, 7:1661 (INIS-mf—6479)
**EINSTEINIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**ELECTRIC ARCS**
**Charged-Particle Transport**
Particle flux emitted from a vacuum arc, 7:1455
**Current Density**
Current densities in anchored cathode spots of a dc mercury vacuum arc, 7:1452
**Magnetic Fields**
Anode spot ion currents and the interaction with axial magnetic fields, 7:1454
Interaction of vacuum arcs with transverse magnetic fields, 7:1453
**ELECTRIC BATTERIES**
*(Devices for production and/or storage of electrical energy from chemical reactions; excludes FUEL CELLS and RADIOISOTOPE BATTERIES.)*
*See also METAL-NONMETAL BATTERIES*
**Design**
Toroidal cell and battery (Patent application), 7:606 (NASA-CASE-LEW—12918-1)
**Electrodes**
All-solid lithium electrodes with mixed-conductor matrix, 7:607
**Performance**
Dissolution and passivation of zinc in concentrated aqueous hydroxide, 7:639
**ELECTRIC DISCHARGES**
*See also ELECTRIC ARCS*
*GLOW DISCHARGES*
**Crossed Fields**
Discharge striking in axially symmetrical electric and magnetic fields, 7:1459
Electron density distribution in anode sheath of low pressure discharge in cross Esub(perpendicular)H fields, 7:1457
Gas discharge investigation in crossed electric and magnetic fields, 7:1458
Theory of discharge striking in highly inhomogeneous axially symmetrical magnetic field, 7:1460
**Dissociation**
Non equilibrium dissociation rates of diatomic species. A comparison between numerical and analytical methods, 7:1470
**Electrical Properties**
Current-voltage behaviour of non-LTE pulse discharges, 7:1442
**Electron Beam Injection**
Electron-beam sustained discharge in nitrogen, 7:1462
**Electron Density**
Electron density distribution in anode sheath of low pressure discharge in cross Esub(perpendicular)H fields, 7:1457
**Magnetic Fields**
Magnetic field effect upon maintenance of continuous optical discharge in gases, 7:1479
**ELECTRIC POWER**
**Prices**
California energy futures: a presentation made to the California Energy Commission, 7:628 (P—300-80-033)
**ELECTRIC UTILITIES**
**Air Pollution Control**
Characterization and control of utility emissions, 7:983
**Environmental Impacts**
Characterization and control of utility emissions, 7:983
**Environmental Policy**
Bubble concept: an examination of two applications in the utility industry, 7:1000
**Load Management**
Comparison between flow-through and flow-by porous electrodes for redox energy storage, 7:635
**ELECTRIC-POWERED VEHICLES**
**Electric Batteries**
Dissolution and passivation of zinc in concentrated aqueous hydroxide, 7:639
**Metal-Nonmetal Batteries**
Reactions of FeS electrodes in LiCl-KCl electrolyte, 7:608
**ELECTRODES**
*See also CATHODES*
**Electric Discharges**
Phenomena taking place on the electrode surface in vacuum gap at high voltages, 7:1451
**Materials**
All-solid lithium electrodes with mixed-conductor matrix, 7:607
**ELECTROMAGNETIC ISOTOPE SEPARATION**
**Ionized Gases**
Partially ionized gas in a travelling high frequency magnetic field, 7:1461
**ELECTROMAGNETIC ISOTOPE SEPARATORS**
**Beam Profiles**
Universal characteristics of a wedge-type beam for high current electromagnetic isotope separators, 7:908 (IA—1356)
**ELECTROMAGNETIC PULSES**
EMPs and nuclear power, 7:556
**ELECTROMAGNETIC PUMPS**
Electromagnetic induction pumps for liquid sodium, 7:402 (INIS-mf—6423)
**Performance Testing**
Testing induction pumps on KAS I facility and problems of safety of work in testing plant, 7:403 (INIS-mf—6423)
**ELECTRON BEAM INJECTION**
**Focusing**
Ion focusing of overneutralized electron beams in metal vapour, 7:1463
**ELECTRON BEAM ION SOURCES**
**Beam Production**
Low-energy ion source for p-type doping in MBE, 7:729
**ELECTRON BEAM TYPE REACTORS**
*See E-BEAM TYPE REACTORS*
**ELECTRON CHANNELING**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)
**ELECTRON COLLISIONS**
**Inner-Shell Ionization**
K-shell ionization of gold by electron and positron impact near the threshold energy, 7:1402
**ELECTRON GUNS**
New electron gun for the S-600 scanning electron microscope, 7:974 (IA—1356)
**ELECTRON MICROSCOPES**
**Electron Guns**
New electron gun for the S-600 scanning electron microscope, 7:974 (IA—1356)
**Remote Control**
Remotely operated scanning electron microscope for the examination of irradiated materials, 7:884
**ELECTRON MICROSCOPY**
Evolution of the equipment and recent developments in the alpha, beta, gamma-laboratory of the European Institute for Transuranium Elements, 7:875
**ELECTRON PAIRS**
**Photoproduction**
Theory of electron-positron pair production at superhigh energy, 7:1500 (KFTI—80-6)
**ELECTRON REACTIONS**
**Deep Inelastic Scattering**
Exchange internucleon interactions in deep inelastic electron scattering by nuclei, 7:1565 (KFTI—79-48)
**Elastic Scattering**
Cross section of electron elastic scattering with $^{12}C$ nucleus as a reference standard for relative measurements, 7:1578 (KFTI—80-6)
Influence of dynamic correlations and of nuclear structure effects on the form factors of excitation of light nuclei by fast electrons, 7:1571 (KFTI—79-48)
**Inelastic Scattering**
Influence of dynamic correlations and of nuclear structure effects on the form factors of excitation of light nuclei by fast electrons, 7:1571 (KFTI—79-48)
Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48)
Problem of monopole resonance in nuclei, 7:1623 (KFTI—79-48)
**Knock-Out Reactions**
Correlation mechanism of NN pair electroproduction on nuclei, 7:1621 (KFTI—79-48)
**Quasi-Elastic Scattering**
Effects of final-state interactions in the $^{12}C(e,e'p)^{11}B$ reaction, 7:1577 (KFTI—80-6)
Experimental study on the (e,e'p) reactions with helium isotopes, 7:1566 (KFTI—79-48)

Nucleon-nucleon potentials and quasi-free scattering of electrons by deuterons, 7:1559 (KFTI—79-48)

**ELECTRON TUBES**

**Breakdown**

Critical field emission currents initiating vacuum breakdown for metals cooled up to liquid-helium temperatures, 7:1444

Dependence of breakdown voltage on adsorbed gases, 7:1450

Phenomena taking place on the electrode surface in vacuum gap at high voltages, 7:1451

Vacuum breakdown along a dielectric surface with an accumulated charge, 7:1449

**Cathodes**

Behaviour of carbon fibre cathodes in vacuum discharges, 7:1447

Influence of surface contamination on cathode erosion by nanosecond discharges in vacuum, 7:1448

Minimum conditions for cathode erosion by electrical discharges in UHV, 7:1446

**Critical Current**

Critical field emission currents initiating vacuum breakdown for metals cooled up to liquid-helium temperatures, 7:1444

**Electric Discharges**

Behaviour of carbon fibre cathodes in vacuum discharges, 7:1447

**ELECTRON-POSITRON INTERACTIONS**

Constraint of color separation on perturbative QCD, 7:1540

Structure of baryonium and its manifestation in multiparticle production processes, 7:1518

**Annihilation**

Observation of the radiative transition PSI $\rightarrow \gamma$E(1420), 7:1489

**Cascade Showers**

Observation of an excess of events in $e^+e^-$ annihilations into neutral final-states leading to three electromagnetic showers at 10 GeV, 7:1496

**Cross Sections**

Observation of an excess of events in $e^+e^-$ annihilations into neutral final-states leading to three electromagnetic showers at 10 GeV, 7:1496

**Inclusive Interactions**

D-meson inclusive production in $e^+e^-$ annihilation, 7:1519

Jet production in $e^+e^-$ collisions to order $\alpha^3$ and $\alpha^4$ and including QCD, 7:1523

**ELECTRONS**

*See also SOLAR ELECTRONS*

**Energy Losses**

Internal and external bremsstrahlung spectra in thick lead and aluminium targets excited by soft beta rays, 7:1643

**Pair Production**

Observation of a direct low-mass $e^+e^-$ continum in $\pi^-p$ interactions at 16 GeV/c, 7:1488

**ELECTROPHORESIS**

**Uses**

Use of electromigration method in physicochemical investigations. Chapter 4, 7:823

**ELECTROSTATIC ACCELERATORS**

*See also TANDEM ELECTROSTATIC ACCELERATORS*
*VAN DE GRAAFF ACCELERATORS*

**Heaters**

Target heater for the experiments on the reactor damage simulation in accelerators, 7:450 (KFTI—79-65)

**EMERGENCIES**

*See ACCIDENTS*

**EMERGENCY CORE COOLING SYSTEM**

*See ECCS*

**EMP**

*See ELECTROMAGNETIC PULSES*

**END USE SECTOR**

*See INDUSTRY*

**ENDOCRINE DISEASES**

*See also HYPERTHYROIDISM*
*HYPOTHYROIDISM*

**Diagnostic Techniques**

Complex diagnosis of thyroid gland disease by in vitro tests without using expensive commercial kits, 7:1110 (INIS-mf—6419)

**ENERGY CONSERVATION**

**Attitudes**

Adoption of energy conservation features in new homes: current practices and proposed policies, 7:637 (PAS—349)

**Research Programs**

Oversight: DOE solar and conservation programs, 7:627 (GPO—65-855)

**ENERGY CONSUMPTION**

**Cost**

Total costs of energy services, 7:611

**ENERGY FACILITIES**

**Risk Assessment**

Comparative health risks of energy production, 7:1052

**ENERGY POLICY**

**Planning**

Technical and economic aspects of sodium cooled nuclear facilities, 7:396 (INIS-mf—6423)

**ENERGY SOURCES**

*See also FOSSIL FUELS*
*NUCLEAR FUELS*
*RENEWABLE ENERGY SOURCES*

**Meetings**

Energy sources: Australia's needs. Proceedings of the Australian Institute of Energy first National Conference, held in Newcastle on February 5-9, 1979, 7:998

**ENERGY SYSTEMS**

**Cost**

Total costs of energy services, 7:611

**Health Hazards**

Comparative health risks of energy production, 7:1052

**ENERGY-LEVEL DENSITY**

**Shell Models**

Theories and approximations of nuclear level densities, 7:1608 (IAEA-SMR—43)

**Statistical Models**

Theories and approximations of nuclear level densities, 7:1608 (IAEA-SMR—43)

**ENGINEERED SAFETY SYSTEMS**

*See also CONTAINMENT SYSTEMS*
*ECCS*

**Materials Testing**

Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217

**Risk Assessment**

Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238

**ENGINEERING**

*See also NUCLEAR ENGINEERING*
*SAFETY ENGINEERING*

**Education**

Engineer's view of science education, 7:1705 (NP—2900461)

**ENGLAND**

*See UNITED KINGDOM*

**ENRICHED URANIUM**

**Forecasting**

Enrichment industry reaches maturity, 7:186

**ENSTATITE**

*See MAGNESIUM SILICATES*

**ENVIRONMENTAL IMPACTS**

**Meetings**

Scientific advances and community risk. Proceedings of a meeting of the Science and Industry Forum of the Australian Academy of Science, held on October 6-7, 1978. 7:235

**ENVIRONMENTAL TRANSPORT**

*See also RADIONUCLIDE MIGRATION*

**Mathematical Models**

Field determination of the physical contaminant transport parameters in a sandy aquifer, 7:1045

**EPIPHYSIS (BONES)**

*See BONE TISSUES*

**ERBIUM**

**Distribution Functions**

Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**ERBIUM 163**
**Energy Levels**
Particle-rotor model analysis of $^{163}$Er, 7:1594 (OUP—81-09)
**Nilsson-Mottelson Model**
Particle-rotor model analysis of $^{163}$Er, 7:1594 (OUP—81-09)
**ERYTHROBLASTS**
*See BONE MARROW CELLS*
**ERYTHROCYTES**
**Hemolysis**
Studies of radiation induced hemolysis of erythrocytes, 7:1144 (INIS-mf—6531)
**ESCHERICHIA COLI**
**Mutations**
Mechanisms of radiation induced mutability in bacteria, 7:1157 (INIS-mf—6531)
**ESTUARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**EURATOM**
**Hot Cells**
Evolution of the equipment and recent developments in the alpha, beta, gamma-laboratory of the European Institute for Transuranium Elements, 7:875
**EUROPEAN ATOMIC ENERGY COMMUNITY**
*See EURATOM*
**EUROPIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**EUROPIUM IONS**
**Electric Discharges**
Peculiarities of electric discharges in mixtures of metal vapors and rare gases at increased pressures, 7:895
**EXPERIMENTAL NEOPLASMS**
**Radioinduction**
Experimental study of cancers induced in the rat by particles with high LET, 7:1193

## F

**F-1260 RESONANCES**
**Particle Production**
Particle production in anti pp annihilation and non-annihilation, 7:1515
**FACILITIES (ENERGY)**
*See ENERGY FACILITIES*
**FACILITIES (NUCLEAR)**
*See NUCLEAR FACILITIES*
**FACILITIES (STORAGE)**
*See STORAGE FACILITIES*
**FACILITIES (TEST)**
*See TEST FACILITIES*
**FALLOUT**
*(For radioactive fallout only.)*
**Global Aspects**
Radioactive fallout in the southern hemisphere from nuclear weapons tests, 7:997
**FAO**
**Evaluation**
Contribution of the Land and Water Development Division of FAO to soil and water conservation in developing countries, 7:1129 (IAEA-TECDOC—236)
**FARADAY GENERATORS**
*See MHD GENERATORS*
**FAST BREEDER TYPE REACTORS**
*See FBR TYPE REACTORS*
**FAST REACTORS**
*See also FBR TYPE REACTORS*
*TAPIRO REACTOR*
**Fuel Elements**
Application of microprobe analysis to the determination of cladding steels carburization in fast reactor fuel elements, 7:413
**Fuel Pins**
Development of the equipment for fission gas collection by laser puncturing, 7:412
**Gamma Dosimetry**
Gamma-ray energy deposition measurements in a heterogeneous core and their analysis, 7:395 (EUR—6813(Vol.2))
**In Core Instruments**
Gamma-ray energy deposition measurements in a heterogeneous core and their analysis, 7:395 (EUR—6813(Vol.2))
**Reactor Materials**
Simple comparison of adjusted data sets for iron based on measuremets in ASPIS and in the cores of fast reactor criticals, 7:415
**Shielding**
Simple comparison of adjusted data sets for iron based on measuremets in ASPIS and in the cores of fast reactor criticals, 7:415
**Spent Fuel Elements**
In cell machines for the inspection of fast reactor fuel elements, 7:888
**FATIGUE**
**Strains**
Analysis of notch strain for cyclic loading, 7:699
**FBR TYPE REACTORS**
*See also GCFR TYPE REACTORS*
*LMFBR TYPE REACTORS*
**Nuclear Fuels**
Advanced fuels for fast breeder reactors. A critical assessment of some phase equilibria, 7:706
**Spent Fuel Elements**
Review and comments about gamma scanning analysis on PWR and FBR fuel elements, 7:511
**FEDERAL REPUBLIC OF GERMANY**
**Atomic Energy Laws**
Standardization and the atomic energy law, 7:429
**Lakes**
Tritium and helium-3 studies in Lake Constance, 7:1030
**Nuclear Power Plants**
Standardization and the atomic energy law, 7:429
**Radioactive Waste Disposal**
Evaluation of product specifications with a safety analysis for a disposal mine, 7:194
**FELDSPARS**
**Diagenesis**
Dissolution and authigenesis of feldspars, 7:106
**Dissolution**
Dissolution and authigenesis of feldspars, 7:106
**Radiation Effects**
Experimental evaluation of changes in properties of natural minerals under irradiation (Gamma radiation of microcline and oligoclase), 7:215
**FEMUR**
**Density**
Clinical determination of absolute density in bone utilizing single and dual energy compton scattering, 7:1098
**FERMILAB ACCELERATOR**
**Data Acquisition Systems**
UNIBUS processor interface for a FASTBUS data acquisition system, 7:914
**FERMIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**FERRATES**
*See IRON OXIDES*

**FERRITIC STEELS**
**Corrosion**
Effect of liquid sodium on behaviour of selected structural materials for steam generators of fast power reactors, 7:648 (INIS-mf—6423)
**Physical Radiation Effects**
Dosimetry experiment 'Dompac'. Neutronic simulation of the thickness of a PWR pressure vessel. Irradiation damage characterization, 7:289 (EUR—6813(Vol.1))

**FERROELECTRIC MATERIALS**
**Crystal Models**
Dynamic theory of phase transition in hydrogen bonded ferroelectric crystals : Transverse susceptibility, 7:1650

**FERTILIZERS**
**Denitrification**
Denitrification as affected by irrigation frequency and applied herbicides, 7:1002
**Losses**
Isotope versus the total balance method to assess nutrient losses and erosion risks, 7:1122 (IAEA-TECDOC—236)
**Optimization**
Improved use of plant nutrients, 7:1136
**Tracer Techniques**
Improved use of plant nutrients, 7:1136

**FESHBACH-PORTER-WEISSKOPF MODEL**
*See OPTICAL MODELS*

**FETUSES**
**Radionuclide Kinetics**
Main regularities of $^{90}Sr$ migration in mother-fetus biological system. Chapter 5.2, 7:1181

**FIELD THEORIES**
**Chirality**
Baecklund transformation, local and nonlocal conservation laws for super-chiral fields, 7:1532
**Conservation Laws**
Baecklund transformation, local and nonlocal conservation laws for super-chiral fields, 7:1532
**Locality**
Baecklund transformation, local and nonlocal conservation laws for super-chiral fields, 7:1532

**FILTERS**
**Performance Testing**
In situ and laboratory testing of iodine filters in Italy, 7:565

**FINITE ELEMENT METHOD**
**Spline Functions**
Some applications of polynomial and spline approximation, 7:1670

**FINLAND**
**Uranium Deposits**
Estimation of the uranium potential of Finnish bedrock, 7:128
Uraniferous phosphorite and apatite-bearing gneisses in the Proterozoic of Finland, 7:92

**FIREDAMP**
*See METHANE*

**FIREPLACES**
**Environmental Impacts**
Impact of residential wood combustion on urban air quality: first ambient measurements, 7:982

**FIRST WALL**
**Failures**
Approaches to assessing the failure resistance of fusion reactor first walls, 7:1696
**Lifetime**
FWLTB - a computer program for predicting the lifetime of a fusion reactor first wall, 7:1695
**Melting**
Response of stainless steel to the pellet debris in a laser fusion reactor, 7:1703
**Wall Loading**
First wall and blanket structure performance, 7:1697

**FISHES**
**Radiochemical Analysis**
Radiological analysis of the river system of the upper Danube, 7:1037 (IAEA-TECDOC—229)

**FISSION BARRIER**
**Nuclear Models**
Fission barrier theory and its application to the calculation of actinide neutron cross-sections, 7:1614 (IAEA-SMR—43)
Fundamentals of the double-humped fission barrier, 7:1613 (IAEA-SMR—43)

**FISSION CHAMBERS**
**Benchmarks**
Dosimetry characterization of a reactor pressure vessel simulator by fission chamber and foil activation measurements, 7:926 (EUR—6813(Vol.2))
**Neutron Dosimetry**
Dosimetry characterization of a reactor pressure vessel simulator by fission chamber and foil activation measurements, 7:926 (EUR—6813(Vol.2))

**FISSION NEUTRONS**
**Delayed Radiation Effects**
Experimental study of cancers induced in the rat by particles with high LET, 7:1193

**FISSION PRODUCT RELEASE**
Behaviour of fission products in PWR primary coolant and defected fuel rods evaluation, 7:313
**Emergency Plans**
Application of cost-effectiveness analysis to restrict the damage caused by accidental release of radioactive material to the environment, 7:570
**Radiation Doses**
Discussion of an environmental dose methodology to obtain compliance with dose limits in the case of postulated accidents, 7:990
**Simulation**
Discussion of an environmental dose methodology to obtain compliance with dose limits in the case of postulated accidents, 7:990

**FISSION PRODUCTS**
**Sampling**
Development of the equipment for fission gas collection by laser puncturing, 7:412

**FISSION YIELD**
**Gamma Spectroscopy**
Computerisation of the γ-spectrometric method for fission yield measurement based on GAMANAL program, 7:942 (ZfK—410)

**FLANGES**
**Leak Testing**
Tests on a 1,75 m O.D. bolted flange assembly with spiral-wound gaskets, 7:391

**FLASKS**
*See CASKS*

**FLOUR**
**Chemical Radiation Effects**
Effect of ionizing radiation sterilization dose on some polysaccharides, 7:836 (INIS-mf—5673)

**FLOW (BLOOD)**
*See BLOOD FLOW*

**FLOWMETERS**
Utilization of thermocouple random signal correlation method for coolant flow rate measuring in nuclear power plants, 7:453

**FLUE GAS**
**Denitrification**
Removal of SOx and NOx from flue gases by electron radiation, 7:984
**Desulfurization**
Removal of SOx and NOx from flue gases by electron radiation, 7:984
Sulfur gas emissions from stored flue gas desulfurization sludges, 7:1005

**FLUIDIZED-BED COMBUSTORS**
**Performance**
Operating experience with a fluidized bed steam generator at Georgetown University, 7:905 (CONF-8004173—11)

**FLUORINE**
**Ion-Atom Collisions**
Multiple k-shell ionization of fluorine by hydrogen and helium ion impacts, 7:1403
**FLUORINE IONS**
**Ion-Atom Collisions**
Recoil charge-state distributions resulting from small impact parameter collisions of F and O projectiles with Ne, 7:1406
**FLY ASH**
**Removal**
Removal of SOx and NOx from flue gases by electron radiation, 7:984
**FOOD AND AGRICULTURE ORGANIZATION**
*See FAO*
**FOOD CHAINS**
**Contamination**
Protective action guides. Theory and application lessons from the Three Mile Island accident, 7:989
**Environmental Exposure Pathway**
Protective action guides. Theory and application lessons from the Three Mile Island accident, 7:989
**FORENSIC SCIENCE**
*See CRIME DETECTION*
**FORTISSIMO REACTOR**
*See RAPSODIE REACTOR*
**FOSSIL FUELS**
*See also COAL*
*NATURAL GAS*
*PETROLEUM*
**Research Programs**
Fossil energy research and development in ERDA (Book chapter), 7:633
**FOSSIL-FUEL POWER PLANTS**
*See also ELECTRIC UTILITIES*
**Environmental Impacts**
Energy sources: Australia's needs. Proceedings of the Australian Institute of Energy first National Conference, held in Newcastle on February 5-9, 1979, 7:998
Impact study of a primary sulfate emission source, 7:985
**Radiation Hazards**
Assessment of biological effects resulting from large scale applications of coal power plant wastes in building technology in Poland, 7:1196
**Waste Product Utilization**
Assessment of biological effects resulting from large scale applications of coal power plant wastes in building technology in Poland, 7:1196
**FOSSILS**
**Paleontology**
Agglutinated benthonic foraminiferal assemblages in the Palaeogene of the central North Sea: their biostratigraphic and depositional environmental significance, 7:35
**Stratigraphy**
Agglutinated benthonic foraminiferal assemblages in the Palaeogene of the central North Sea: their biostratigraphic and depositional environmental significance, 7:35
**FRACTURE MECHANICS**
**Meetings**
Fracture and fatigue, elasto-plasticity, thin sheet and micromechanisms problems, 7:677
**FRACTURES**
**Meetings**
Fracture and fatigue, elasto-plasticity, thin sheet and micromechanisms problems, 7:677
**FRESH WATER**
**Radionuclide Migration**
Mobility and retention of $^{60}$Co in soils in coastal areas, 7:1046
**FRESH WATER ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**FRICKE DOSEMETERS**
*See CHEMICAL DOSEMETERS*
**FRIEDEL-CRAFTS REACTION**
**Tracer Techniques**
Applications of isotopic labeling to the study of Friedel-Crafts reactions. Chapter 3, 7:827
**FUEL ASSEMBLIES**
*See also FUEL ELEMENT CLUSTERS*
**Performance Testing**
Simulating thermodynamic effects in liquid sodium reactor facilities using electrically heated fuel element mock-ups, 7:400 (INIS-mf—6423)
**Test Facilities**
Simulating thermodynamic effects in liquid sodium reactor facilities using electrically heated fuel element mock-ups, 7:400 (INIS-mf—6423)
Technological research of components and materials using UJV sodium stand, 7:399 (INIS-mf—6423)
**Wear**
Instrument to measure the wear scars formed on the tie bar of the CAGR fuel assembly, 7:354
**FUEL ASSEMBLY DISMANTLING**
**Laser Drilling**
Laser cutting equipment for dismantling irradiated PFR fuel sub-assemblies, 7:886
**FUEL BUNDLES**
*See FUEL ELEMENT CLUSTERS*
**FUEL CANS**
**Carburization**
Application of microprobe analysis to the determination of cladding steels carburization in fast reactor fuel elements, 7:413
**Creep**
Prediction of creep transients in Zircaloy fuel cladding using anelastic strain model, 7:522
**Deformation**
Ballooning of cladding tubes, 7:487 (IWGFPT—7)
Development and correlation of cladding creep and irradiation growth models, 7:476 (IWGFPT—7)
MABEL-2. A code to analyze cladding deformation in a loss-of-coolant accident: status, 7:552 (IWGFPT—7)
**Destructive Testing**
Measurement and analysis of stress rupture tests on CAGR cladding tubes, 7:164
**Plasticity**
Plastic instability of Zircaloy cladding submitted to LOCA conditions, 7:585
**Ruptures**
Development of a burst criterion for Zircaloy fuel cladding under LOCA conditions, 7:550 (IWGFPT—7)
**Stress Corrosion**
Experiments to settle an ISCC hypothesis for Zry-tubing (Iodine stress corrosion cracking), 7:503 (IWGFPT—8)
Implications of recent developments in the plastic fracture mechanics field to the PCI stress corrosion problem, 7:481 (IWGFPT—7)
Stress corrosion testing of irradiated Zircaloy cladding and its relevance to PCI failure, 7:492 (IWGFPT—8)
Stress corrosion cracking of Zircaloy. The use of laboratory data to predict in-reactor behaviour, 7:495 (IWGFPT—8)
Threshold values characterizing iodine-induced SCC of Zircaloys, 7:494 (IWGFPT—8)
**Swelling**
Theoretical free energies for superplasticity and dislocation creep. The origin of the high ductility in superplastic flow, 7:475 (IWGFPT—7)
**FUEL COOLING INSTALLATIONS**
*See SPENT FUEL STORAGE*
**FUEL CYCLE**
Recycling of actinides in light water reactors, 7:431
**Safeguards**
Taking stock after INFCE, 7:619
**FUEL ELEMENT CLUSTERS**
**Post-Irradiation Examination**
Examination of heavily defected fuel-pin bundles, 7:516
**Supports**
Fuel bundle end plate analysis by code SPACE, 7:385
**FUEL ELEMENT FAILURE**
Experimental observations of the PCI failure occurrence on power ramping, 7:491 (IWGFPT—8)
Stress corrosion cracking of Zircaloy. The use of laboratory data to predict in-reactor behaviour, 7:495 (IWGFPT—8)
**Computer Codes**
Progress with the probabilistic fuel failure code POSHO, 7:486 (IWGFPT—7)

**Fission Product Release**
Behaviour of fission products in PWR primary coolant and defected fuel rods evaluation, 7:313
Experimental investigation of release mechanisms responsible for airborne contamination seen during post-transport underwater unloading of a failed PWR spent fuel assembly, 7:297 (INIS-mf—6447)
**Stress Corrosion**
Failure boundary for stress corrosion cracking based on fuel temperature and cladding load. A new approach to improving fuel reliability, 7:493 (IWGFPT—8)

**FUEL ELEMENTS**
*See also FUEL PINS*
*FUEL RODS*
*NUCLEAR FUELS*
*SPENT FUEL ELEMENTS*
**Fission Product Release**
Model for simulating non-equilibrium fission gas behaviour, 7:478 (IWGFPT—7)
**Fuel-Cladding Interactions**
Pellet-clad interaction observations in boiling water reactor fuel elements, 7:277 (IWGFPT—8)
**Gamma Fuel Scanning**
Gamma scanning of full scale HTR fuel elements, 7:351
**Materials Testing**
Need for standardization in the field of neutron radiography, 7:943
**Moderately Enriched Uranium**
Technical problems in case of utilizing uranium of medium enrichment for a research reactor, 7:543 (KURRI-TR—192)
**Neutron Radiography**
Need for standardization in the field of neutron radiography, 7:943
**Performance**
Probabilistic evaluation of fuel element performance by the combined use of a fast running simplistic and a detailed deterministic fuel performance code, 7:485 (IWGFPT—7)
**Performance Testing**
Experimental strategy of fuel performance testing with respect to PCI, 7:498 (IWGFPT—8)
Use of probabilistic fuel performance codes in the planning and evaluation of irradiation experiments, 7:489 (IWGFPT—8)

**FUEL PELLETS**
**Fabrication**
Effect of precompaction on sintered $UO_2$ pellets, 7:519
Factors affecting the sintered density of plutonium oxide, 7:521
Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors, 7:419
**Physical Radiation Effects**
In-reactor densification and relocation of $UO_2$ pellet fuel: preliminary results from the Springfields programme, 7:484 (IWGFPT—7)
Steady state behaviour of gaseous fission products in $UO_2$ nuclear fuel at low temperature, 7:520
**Production**
Aspects of large scale production of $UO_2$ pellets, 7:518
**Quality Control**
Characterisation of sintered $UO_2$ pellets relevant to fuel design and performance, 7:381

**FUEL PINS**
**Design**
Design of fuel pins containing by-product actinides for irradiation in LWR and FBR power plants, 7:187 (EUR—6929)
**Gamma Fuel Scanning**
Experience gained in the accurate measurement of fission product distributions by axial fuel pin gamma scanning, 7:513
**Gas Analysis**
Development of the equipment for fission gas collection by laser puncturing, 7:412
**Mechanical Tests**
Equipment for mechanical piercing and free volume determination, 7:506
**Performance**
In-reactor densification and relocation of $UO_2$ pellet fuel: preliminary results from the Springfields programme, 7:484 (IWGFPT—7)
**Performance Testing**
Power ramp performance of vipac fuel, 7:490 (IWGFPT—8)
**Remote Handling Equipment**
System for PIE of irradiated fuel pins, employing minimal active volume and remotely controlled transport system, 7:872
**Volume**
Equipment for mechanical piercing and free volume determination, 7:506

**FUEL REPROCESSING PLANTS**
**Hot Cells**
PFR reprocessing plant cave, 7:866
**Radioactive Effluents**
Atmospheric dispersion study with $^{85}Kr$ and $SF_6$ gas, 7:993
Study and measurement of the atmospheric pollution by $^{85}Kr$, 7:992

**FUEL RODS**
**Defects**
Behavior of defective pressurized water reactor fuel rods during power ramp and power-cooling-mismatch conditions, 7:560
**Eddy Current Testing**
Eddy-current testing as a tool for post-irradiation examination, 7:508
**Fabrication**
In-cell refabrication of experimental fuel rods using rods pre-irradiated in a power reactor, 7:507
**Fission Product Release**
Effects of fission gas release on PWR fuel rod design and performance, 7:299 (IWGFPT—7)
Evaluation of gas release modelling approaches as to their applicability in fuel behaviour models, 7:477 (IWGFPT—7)
**Fuel-Cladding Interactions**
Performance of mixed oxide fuel at high burnup and comparison with $UO_2$ fuel, 7:500 (IWGFPT—8)
**Grain Growth**
Comparison of grain growth measurements and predictions for fuel rods S176-6, -7, -8, and -9, 7:482 (IWGFPT—7)
**Performance**
CONTACT 1 and 2 experiments: behavior of PWR fuel rod up to 15000 $MWd.tu^{-1}$, 7:302 (IWGFPT—7)
Development and correlation of cladding creep and irradiation growth models, 7:476 (IWGFPT—7)
Development of program FREC: theory and models, 7:480 (IWGFPT—7)
Effects of uncertainties of experimental data in the benchmarking of a computer code, 7:488 (IWGFPT—7)
FEMAXI-III: an axisymmetric finite element computer code for the analysis of fuel rod performance, 7:483 (IWGFPT—7)
Predictions of the thermomechanical code RESTA compared with fuel element examinations after irradiation in the BR3 reactor, 7:301 (IWGFPT—7)
Treatment of numerical problems due to rapid creep rate in the fuel performance calculation by FEM, 7:472 (IWGFPT—7)
**Performance Testing**
Behavior of defective pressurized water reactor fuel rods during power ramp and power-cooling-mismatch conditions, 7:560
Experimental observations of the PCI failure occurrence on power ramping, 7:491 (IWGFPT—8)
Inpile irradiations for verification of pellet clad interaction predictions, 7:497 (IWGFPT—8)
**Pressurizing**
Prediction of the optimum filling pressure for PWR fuel rods, 7:300 (IWGFPT—7)
**Stress Analysis**
BACO fuel rod analysis computer program, 7:384

**FUEL-CLADDING INTERACTIONS**
Analysis of PCI by FEMAXI-III, 7:501 (IWGFPT—8)
Analytical interpretation of PCI related experiments, 7:306 (IWGFPT—8)
Experience and plans with PCI protection in KWU LWR plants, 7:502 (IWGFPT—8)
Implications of recent developments in the plastic fracture mechanics field to the PCI stress corrosion problem, 7:481 (IWGFPT—7)

In-pile measurements of pellet cladding interaction and relaxation, 7:474 (IWGFPT—7)
Inpile irradiations for verification of pellet clad interaction predictions, 7:497 (IWGFPT—8)
Mechanistic considerations pertinent to the PCI fuel failure phenomenon, 7:504 (IWGFPT—8)
Operation with monosequences in ASEA-ATOM BWR. A way of reducing the impact of PCI, 7:279 (IWGFPT—8)
PCMI modelling in COMETHE, 7:496 (IWGFPT—8)
Pellet-cladding interactions. Detection and location of PCI defects through fission product release during reactor operation/transients and the concept of cumulative PCI damage, 7:278 (IWGFPT—8)
Theorical study and modelling of fuel cladding interaction and stress corrosion concerning the light water reactor fuel elements, 7:298 (IWGFPT—7)

**Compatibility**
Thermodynamic studies of thorium carbide fuel preparation and fuel/clad compatibility, 7:707

**Computer Calculations**
Comparison of FEMAXI-III code calculations with irradiation experiments, 7:479 (IWGFPT—7)

**Data Compilation**
Statistical trends observed in published data of PCI failures, 7:499 (IWGFPT—8)

**FUGEN ATR**
*See JATR REACTOR*

**FUMES**
*See AEROSOLS*

**FUSED SALTS**
*See MOLTEN SALTS*

**FUSION HEAT**

**Calculation Methods**
Thermodynamic basis for selecting heat storage materials, 7:269

**FUSION REACTORS**
*See THERMONUCLEAR REACTORS*

## G

**GABON**

**Uranium Deposits**
Alkali and alkaline earth element studies at Oklo, 7:60

**GADOLINIUM**

**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**GADOLINIUM 157**

**Energy Levels**
Gamma multiplicity of the decay of highly excited low spin states in $^{157}$Gd, 7:1595 (OUP—81-09)

**GALLIUM ALLOYS**

**Ion Scattering Analysis**
Quantitative analysis of III-V compounds, using low-energy ion-scattering spectrometry (ISS), 7:772

**GALLIUM ARSENIDES**

**Backscattering**
Surface analyses of GaAs by ion beam backscattering method, 7:1429

**Ion Scattering Analysis**
Quantitative analysis of III-V compounds, using low-energy ion-scattering spectrometry (ISS), 7:772

**GALLIUM IONS**

**Ion Sources**
Liquid metal field-emission ion sources and their applications, 7:1392

**GAMMA DOSIMETRY**

**Meetings**
Review of session L: dosimetry techniques, 7:925 (EUR—6813(Vol.2))

**Potassium Chlorides**
KCl crystal for dosimetry of hard X-ray and gamma radiation, 7:968

**GAMMA FUEL SCANNING**
Recent improvements in facilities for gamma-scanning and other non-destructive examinations of irradiated materials at ECN's hot cell plant L.S.O., 7:873

**Data Acquisition Systems**
Computer based recording and handling of non-destructive PIE data at Risoe, 7:874

**GAMMA LOGGING**
Nuclear logging methods ((part of chapter 7 - Geophysical measurements in boreholes)), 7:977

**GAMMA RADIATION**

**Biological Radiation Effects**
Frameshift mutagenesis by ultraviolet and gamma radiation, 7:1159 (INIS-mf—6531)

**Mutagenesis**
Frameshift mutagenesis by ultraviolet and gamma radiation, 7:1159 (INIS-mf—6531)

**GAMMA SPECTRA**

**Spectra Unfolding**
Analysis of gamma-ray spectra. Chapter 3. Section 1 (Obtained in neutron activation), 7:748
Simplification of calculation algorithm for γ-spectra processing, 7:1645
Tables of gamma-ray peaks observed in reactor neutron activation analysis. Appendix. Chapter 6, 7:761

**GAMMA SPECTROMETERS**
*See also MOESSBAUER SPECTROMETERS*

**Li-Drifted Ge Detectors**
Real time operation of a multiple gamma measurement installation, 7:946

**On-Line Measurement Systems**
Real time operation of a multiple gamma measurement installation, 7:946

**GAMMA SPECTROSCOPY**

**Data Processing**
Computerisation of the γ-spectrometric method for fission yield measurement based on GAMANAL program, 7:942 (ZfK—410)

**GAMMA-GAMMA LOGGING**
Nuclear logging methods ((part of chapter 7 - Geophysical measurements in boreholes)), 7:977

**GAS COOLANTS**
*See GASES*

**GAS COOLED FAST BREEDER REACTORS**
*See GCFR TYPE REACTORS*

**GAS COOLED GRAPHITE MODERATED REACTOR**
*See GCR TYPE REACTORS*

**GAS LASERS**
*See also CARBON DIOXIDE LASERS*
Advanced lasers for fusion, 7:1676

**Electric Discharges**
Energy balance of noble gas ion laser discharges, 7:900

**Emission Spectra**
Emission properties of nitrogen laser discharges, 7:898

**Ion Acoustic Waves**
Ion acoustic waves in noble gas ion lasers, 7:901

**Plasma**
Collisional radiative model for the argon ion system, 7:899
Investigation of some processes in the hydrogen laser plasma, 7:891

**GASES**
*See also COSMIC GASES*
*COVER GAS*
*FLUE GAS*
*IONIZED GASES*
*NATURAL GAS*
*RARE GASES*
O-positronium pick-off quenching in dense gases, 1. Theoretical, 7:1431

**Breakdown**
Dependence of breakdown voltage on adsorbed gases, 7:1450

Vacuum breakdown along a dielectric surface with an accumulated charge, 7:1449
**Electric Discharges**
Magnetic field effect upon maintenance of continuous optical discharge in gases, 7:1479
Some peculiarities of a gas discharge in a gap with dielectric, 7:1465
**Positron Collisions**
Positron interactions in gases, 7:1430
**GASTROINTESTINAL TRACT**
*See also STOMACH*
**Biomedical Radiography**
Diagnostic and therapeutic value of angiography in gastro-intestinal surgical stump haemorrhages, 7:1090
Therapeutic angiography in acute processes of the alimentary tract, 7:1089
**GCFR TYPE REACTORS**
**Pressure Vessels**
Multicavity PCPVs for HTR and GCFR systems, 7:336 (IWGHTR—2)
**GCR TYPE REACTORS**
*See also CALDER HALL A-1 REACTOR*
*CALDER HALL A-2 REACTOR*
*CALDER HALL B-3 REACTOR*
*CALDER HALL B-4 REACTOR*
*CHAPELCROSS-1 REACTOR*
*CHAPELCROSS-2 REACTOR*
*CHAPELCROSS-3 REACTOR*
*CHAPELCROSS-4 REACTOR*
**Reactor Vessels**
EDF's (Electricite de France) in service control for GCR type reactor vessels, 7:339 (IWGHTR—2)
**GEIGER-MUELLER COUNTERS**
**Calibration**
'Intelligent' radiation instruments, 7:954
**Microprocessors**
'Intelligent' radiation instruments, 7:954
**GE(LI) DETECTORS**
*See LI-DRIFTED GE DETECTORS*
**GENERATORS (STEAM)**
*See STEAM GENERATORS*
**GENETIC RADIATION EFFECTS**
**Radiation Hazards**
Carcinogenic and genetic hazards from environmental, medical and industrial radiation sources, 7:1171 (INIS-mf—6531)
**GENTILLY-2 REACTOR**
**Construction**
Design and construction progress on Gentilly 2, Cordoba, Point Lepreau, and Wolsung projects, 7:382
**Reactor Control Systems**
Hierarchy of essential CANDU reactor control functions in a distributed system, 7:537 (AECL—7056)
**GEOLOGIC DEPOSITS**
*See also ALLUVIAL DEPOSITS*
*COAL DEPOSITS*
*MORAINES*
*NATURAL GAS DEPOSITS*
*PETROLEUM DEPOSITS*
*SALT DEPOSITS*
*URANIUM DEPOSITS*
**Data Acquisition**
Data management for evaluation of deposits at Nuclebras, 7:126
**Information Systems**
Data management for evaluation of deposits at Nuclebras, 7:126
**Radionuclide Migration**
Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
**GEOLOGIC FAULTS**
**Gamma-Gamma Logging**
Detection of rock massif stress changes by gamma-gamma logging in Prague underground tunnelling, 7:1268 (INIS-mf—6422)
Study of some characteristics of a rock massif by radioisotope methods, 7:1267 (INIS-mf—6422)
**Neutron-Gamma Logging**
Study of some characteristics of a rock massif by radioisotope methods, 7:1267 (INIS-mf—6422)
**Radiometric Surveys**
First radiometric logging studies in Czechoslovakia in surveying geological dislocations, 7:1265 (INIS-mf—6422)
**GEOTHERMAL POWER PLANTS**
**Environmental Impacts**
Compliance plan for PG and E geysers unit 16, 7:272 (P—800-81-005)
**Environmental Quality**
USGS and Engineering and Environmental Division joint compliance monitoring report for Sacramento, CA Municipal Utility District's SMUDGEO No. 1 Geothermal project. Appendix D to final decision, 7:271 (P—800-81-003)
**Licensing**
Compliance plan for PG and E geysers unit 16, 7:272 (P—800-81-005)
USGS and Engineering and Environmental Division joint compliance monitoring report for Sacramento, CA Municipal Utility District's SMUDGEO No. 1 Geothermal project. Appendix D to final decision, 7:271 (P—800-81-003)
**GERMANIUM**
**Ion Collisions**
K$\beta$/K$\alpha$ intensity ratios and energy shifts of K$\beta$ rays produced by N-ion impact, 7:1399
**GERMANIUM 72 TARGET**
**Proton Reactions**
Proton inelastic scattering by sup(72,74)Ge nuclei, 7:1587 (KFTI—79-40)
**GERMANIUM 74 TARGET**
**Proton Reactions**
Proton inelastic scattering by sup(72,74)Ge nuclei, 7:1587 (KFTI—79-40)
**GERMANIUM ALLOYS**
**Physical Radiation Effects**
Calculation of the driving force for the radiation induced precipitation of $Ni_3Si$ in nickel-silicon alloys, 7:673
**Precipitation**
Calculation of the driving force for the radiation induced precipitation of $Ni_3Si$ in nickel-silicon alloys, 7:673
**GERMANY (FEDERAL REPUBLIC)**
*See FEDERAL REPUBLIC OF GERMANY*
**GEYSERS GEOTHERMAL FIELD**
**Geothermal Power Plants**
Compliance plan for PG and E geysers unit 16, 7:272 (P—800-81-005)
USGS and Engineering and Environmental Division joint compliance monitoring report for Sacramento, CA Municipal Utility District's SMUDGEO No. 1 Geothermal project. Appendix D to final decision, 7:271 (P—800-81-003)
**GIANT CELLS**
*See TUMOR CELLS*
**GIANT RESONANCE**
**Reviews**
Problem of monopole resonance in nuclei, 7:1623 (KFTI—79-48)
**GLASS**
*See also BOROSILICATE GLASS*
**Chemical Analysis**
ESCA investigation of molybdenum containing silicate and phosphate glasses, 7:200
**Chemical Composition**
ESCA investigation of molybdenum containing silicate and phosphate glasses, 7:200
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**Crystallization**
Stable product low leach glasses, 7:202
**Dissolution**
Dissolution of glass during irradiation by $^{60}$Co $\gamma$-rays, 7:727
**Hydration**
Durability of rhyolitic obsidian glass inferred from hydration dating research, 7:714
**Leaching**
Mechanisms for hydrothermal leaching of glass and glass-ceramic nuclear waste forms, 7:717
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
Stable product low leach glasses, 7:202

Surface analysis: its uses and abuses in waste form evaluation, 7:716
**Multi-Element Analysis**
Forensic applications. Chapter 5. Section 6, 7:760
**Radiation Effects**
Dissolution of glass during irradiation by $^{60}Co$ γ-rays, 7:727
**Stability**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**Structural Chemical Analysis**
Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses, 7:201
**GLAUBER'S SALT**
*See SODIUM SULFATES*
**GLIOBLASTOMAS**
*See NEOPLASMS*
*NERVOUS SYSTEM DISEASES*
**GLOBULINS-ALPHA**
**Morphological Changes**
Structural and functional change peculiarities in immunocompetent organs during radiation injury in animals treated with αZ-macroglobulin, 7:1223
**GLOVEBOXES**
**Decontamination**
Decontamination techniques suitable for post-irradiation examination caves, 7:846
**GLOW DISCHARGES**
**Fluid Mechanics**
Influence of fluid-dynamic phenomena on the transverse electrical glow discharge, 7:1443
**Wave Forms**
Wave structure of an electric discharge cathode zone in the helium flow, 7:1464
**GLUCOPROTEINS**
**Metabolism**
Metabolism breakage of non-collagenous proteins and skin ultrastructure of rats in case of its local radiation acute injury, 7:1225
**GLUONS**
Gluon jet effects in deep inelastic lepton-hadron collisions, 7:1537
**GOES SATELLITES**
Remote sensing of soil radionuclide fluxes in a tropical ecosystem, 7:1007
**GOLD**
**Electron Collisions**
K-shell ionization of gold by electron and positron impact near the threshold energy, 7:1402
**Positron Collisions**
K-shell ionization of gold by electron and positron impact near the threshold energy, 7:1402
**GOLD 197 TARGET**
**Argon 40 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Neon 20 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Neon 22 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**GOLD IONS**
**Ion Sources**
Liquid metal field-emission ion sources and their applications, 7:1392
**GRANITES**
**Chemical Composition**
Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
**Geochemistry**
Geochemical investigations in the Mt. Bundey area, Northern Territory, 7:1272
Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
**Isotope Dating**
Granite ages in the Pine Creek Geosyncline, 7:1253
Granitoids in the Pine Creek Geosyncline, 7:1254
**Petrogenesis**
Granitoids in the Pine Creek Geosyncline, 7:1254
**Sorptive Properties**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**Thermal Conductivity**
Thermal conductivity of selected repository minerals, 7:197
**GRANULOCYTES**
*See LEUKOCYTES*
**GRAPHITE**
**Chemical Radiation Effects**
Corrosion of nuclear graphites with water vapor in helium, 7:731
**Corrosion**
Behaviour of hydrogenous compounds in reactor coolants, 7:366
Corrosion of nuclear graphites with water vapor in helium, 7:731
Implications of radiolytic graphite corrosion on AGR brick integrity, 7:364
Modelling of AGR radiolytic graphite corrosion, 7:363
Role of adsorption processes in gas graphite reactions in high temperature gas-cooled reactors, 7:360
**Gasification**
Nickel-catalysed gasification of graphite by carbon dioxide, 7:725
**Oxidation**
Calculation of methane profiles in graphite structures, 7:722
Development of transport and non-transport porosity in radiolytic graphite oxidation, 7:721
Graphite oxidation experiment to high weight loss under CAGR conditions, 7:362
Graphite oxidation by moisture, 7:732
Influence of structure on the thermal oxidation of reactor graphites, 7:723
Investigation of nuclear grade graphite for possible sea-water contamination using a thermal oxidation technique, 7:724
Nickel-catalysed gasification of graphite by carbon dioxide, 7:725
Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
Oxidation of carbonaceous deposit in nuclear reactors, 7:365
Radiolytic carbon gasification, 7:840
**Permeability**
Calculation of methane profiles in graphite structures, 7:722
**Physical Radiation Effects**
3-D inelastic analysis of HTR graphite structures and a comparison with A 2-D approach, 7:432
Irradiation experiment with a large graphite block, 7:737
**Pollution**
Investigation of nuclear grade graphite for possible sea-water contamination using a thermal oxidation technique, 7:724
**Radiation Effects**
Investigation of nuclear grade graphite for possible sea-water contamination using a thermal oxidation technique, 7:724
**Thermal Stresses**
3-D inelastic analysis of HTR graphite structures and a comparison with A 2-D approach, 7:432
**GRAPHITE MODERATED REACTORS**
*See also GCR TYPE REACTORS*
*HTGR TYPE REACTORS*
**Coolants**
Oxidation of carbonaceous deposit in nuclear reactors, 7:365
**GREAT BRITAIN**
*See UNITED KINGDOM*
**GREENLAND**
**Uranium Deposits**
Uranium potential of Greenland - A geological analysis of favourability, 7:129
**GROUND DISPOSAL**
*See UNDERGROUND DISPOSAL*
**GROUND WATER**
**Contamination**
Groundwater pollution considered as a continuous injection of tracers, 7:1035
Solute transport in the unsaturated zone of the Chalk, 7:1034

**Fluid Flow**
Groundwater pollution considered as a continuous injection of tracers, 7:1035
Groundwater flow patterns in the western Libyan Arab Jamahiriya evaluated from isotopic data, 7:1021
**Geochemistry**
Environmental isotope study of groundwater systems in the Republic of Djibouti, 7:1026
Ground water geochemistry in the vicinity of the Jabiluka deposits, 7:99
**Hydrology**
Interpretation of environmental isotopic groundwater data. Arid and semi-arid zones, 7:1013
Relations between surface and ground water studied by tritium analyses, 7:1033 (INIS-mf—6422)
**Pollution**
Proceedings of the groundwater pollution conference, Perth, Western Australia, Feburary 19-23, 1979, 7:232
**Radionuclide Migration**
Evaluation of the ability to predict radionuclide transport in groundwater flow systems, 7:228
**Water Chemistry**
Conceptual hydrochemical model for alluvial aquifers on the Saudi Arabian basement shield, 7:1024
**Water Quality**
Effects of uranium mining of ground water in Ambrosia Lake area, New Mexico, 7:233

**GROUND-WATER RESERVES**
*See AQUIFERS*

**GROWTH HORMONE-RELEASE INHIBITING FACTOR**
*See SOMATOSTATIN*

**GUNDREMMINGEN-2 REACTOR**
**Shielding**
Shielding data requirement for thermal power reactors of boiling water and gas cooled type, 7:286

## H

**HADDAM NECK REACTOR**
*See CONNECTICUT YANKEE REACTOR*

**HADRON REACTIONS**
**Inelastic Scattering**
Particle interactions with nuclei in the energy range of 0.1-5 TeV, 7:1568
**Quark Model**
Hadron-nucleus total cross sections in the quark-parton model, 7:1624 (TRI—79-1)

**HADRON-HADRON INTERACTIONS**
Structure of baryonium and its manifestation in multiparticle production processes, 7:1518
Theory of QCD plasma and hadronic collisions, 7:1541
**Angular Distribution**
Angular flow of charge and energy in hadron hadron collisions, 7:1511
**Differential Cross Sections**
Production of D- and PSI-mesons in hadron interactions, 7:1520

**HADRONS**
*See also MESONS*
**Composite Models**
Naive model of hadrons and hadronic processes, 7:1516
**Diagrams**
Leptons, quarks and hadrons in a same theoretical approach, 7:1527 (IPNO-TH—80-49)
**Jet Model**
Jet properties and the parton interpretation of the leading log scheme, 7:1554
**Mass Spectra**
Attempt to derive the hadron mass spectrum from the topological expansion, 7:1526 (IPNO-TH—80-49)
**Pair Production**
Symmetric hadron pairs at large transverse moments as a test of the QCD model, 7:1542
**Structure Functions**
Jet properties and the parton interpretation of the leading log scheme, 7:1554
Quarks and hadrons: structure functions and fragmentation functions, 7:1534

**HAFNIUM**
**Activation Analysis**
Analysis of zirconium and zirconium oxide. Hafnium determination by activation, 7:791 (CEA-CETAMA—7)
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Metallurgical Effects**
Corrosion behaviour of Ni-Re, Ni-Re-Mo, Ni-Re-Hf, Ni-Re-W-Hf alloys, 7:686
**Spectroscopy**
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)

**HAIR**
**Activation Analysis**
Trace element concentrations in human hair: a study by instrumental neutron activation analysis, 7:778
**Multi-Element Analysis**
Forensic applications. Chapter 5. Section 6, 7:760

**HALDEN HEAVY BOILING WATER REACTOR**
*See HBWR REACTOR*

**HALIDES**
*See also BROMIDES*
*CHLORIDES*
**Mass Spectroscopy**
Mass spectrometric isotope dilution analysis of trace amounts of halides, 7:765

**HALL GENERATORS**
*See MHD GENERATORS*

**HAMSTERS**
**Radionuclide Kinetics**
Subcellular distribution of $^{239}$Pu in the liver of rat, mouse, Syrian and Chinese hamster, 7:1183

**HARD COAL**
*See ANTHRACITE*
*BLACK COAL*

**HARD X RADIATION**
**X-Ray Detection**
Observation of soft x-ray and hard x-ray by the satellite Hakucho, 7:1371

**HASTELLOY C**
**Corrosion**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217

**HASTELLOY X**
**Corrosion**
Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys, 7:683
**Corrosion Resistance**
Corrosion resistance of Ni and Mo coated super alloy in He-high temperature environment, 7:682

**HASTELLOYS**
*See also HASTELLOY C*
*HASTELLOY X*
**Fracture Properties**
Elastic plastic fracture toughness values for a Hastelloy alloy sample submitted to a static load, 7:689

**HBWR REACTOR**
**Fuel-Cladding Interactions**
Analysis of PCI by FEMAXI-III, 7:501 (IWGFPT—8)
Comparison of FEMAXI-III code calculations with irradiation experiments, 7:479 (IWGFPT—7)

**HCG**
**Radioimmunoassay**
Importance of HCG determination for the diagnosis of extrauterine pregnancy, 7:1109 (INIS-mf—6419)

**HD 8077**
*See NICKEL BASE ALLOYS*

**HEALTH HAZARDS**
**Comparative Evaluations**
Comparative health risks of energy production, 7:1052

**HEAT EXCHANGERS**
**Design**
Design of heat exchangers for high-temperature reactors, 7:377
**Fretting Corrosion**
Vibrational and fretting wear of heat exchangers, 7:442 (AECL—6885)
**Specifications**
IHX design for pool type LMFBR system application, 7:417
**Wear**
Vibrational and fretting wear of heat exchangers, 7:442 (AECL—6885)
**HEAT OF FUSION**
*See FUSION HEAT*
**HEAT STORAGE**
*See also LATENT HEAT STORAGE*
*THERMOCHEMICAL HEAT STORAGE*
**Materials**
Introduction to Solar Materials Science, 7:261
**HEAT TRANSFER FLUIDS**
**Thermochemical Processes**
Application of reversible chemical reactions to solar thermal energy systems, 7:270
**HEATERS**
**Reactor Simulators**
Target heater for the experiments on the reactor damage simulation in accelerators, 7:450 (KFTI—79-65)
**Specifications**
Target heater for the experiments on the reactor damage simulation in accelerators, 7:450 (KFTI—79-65)
**HEATING**
*See also SPACE HEATING*
**Hybrid Resonance**
Lower hybrid heating in the Alcator A tokamak, 7:1675
**HEAVY ION ACCELERATORS**
**Beam Production**
Advances and limitations of commercial ion-implantation equipment, 7:916
**Dielectric Track Detectors**
Study of nuclear reactions in high energy using solid state track detectors, 7:913 (KURRI-TR—190)
**Gamma Dosimetry**
Dose rates during experiments with heavy ions, 7:919
**Irradiation Plants**
200kV heavy-ion accelerator for radiation damage research and its use for studies of radiation-enhanced diffusion and segregation, 7:920
**Neutron Dosimetry**
Dose rates during experiments with heavy ions, 7:919
**HEAVY ION REACTIONS**
*See also ARGON 40 REACTIONS*
*NEON 20 REACTIONS*
*NEON 22 REACTIONS*
*OXYGEN 16 REACTIONS*
*URANIUM 238 REACTIONS*
**Nuclear Reaction Kinetics**
Nuclear collisions at intermediate energies, 7:1617 (JINR-D—4-80-385)
**HEAVY NUCLEI**
*See also ACTINIDE NUCLEI*
**Giant Resonance**
Electric and magnetic giant resonances of low multipolarity studied with inelastic electron scattering ($^{11}$B, $^{16}$C, $^{16}$O, $^{28}$Si, sup(40, 42, 44, 48)Ca, $^{58}$Ni, $^{90}$Ir, $^{140}$Ce and $^{208}$Pb isotopes), 7:1556 (JINR-D—4-80-385)
**Hadron Reactions**
Particle interactions with nuclei in the energy range of 0.1-5 TeV, 7:1568
**Shell Models**
Inner shells in heavy nuclei, 7:1636 (IPNO-TH—80-49)
**HEAVY WATER**
**Production**
Mass spectrometers as an analytical tool in heavy water production, 7:246
**Transport**
Risk assessment applied to transportation of tritiated heavy water, 7:243 (INIS-mf—6447)
**HEAVY WATER COOLANT**
*See HEAVY WATER*
**HEAVY WATER MODERATED REACTORS**
*See also CANDU TYPE REACTORS*
*CIRUS REACTOR*
*PHWR TYPE REACTORS*
*SGHWR REACTOR*
**Spent Fuel Elements**
Some Windscale experience of the underwater examination of water reactor fuel assemblies, 7:284
**HEAVY WATER PLANTS**
Need for accurate deuterium analysis in a heavy water plant and its achievement, 7:245
**Data Acquisition Systems**
Distributed systems in the heavy water plant environment, 7:244 (AECL—7056)
**HECTORITE**
*See MONTMORILLONITE*
**HELIUM**
**Chemical Reaction Kinetics**
Role of adsorption processes in gas graphite reactions in high temperature gas-cooled reactors, 7:360
**Corrosive Effects**
Corrosion of inconel 617 in simulated HTGR helium environment, 7:684
**Glow Discharges**
Wave structure of an electric discharge cathode zone in the helium flow, 7:1464
**Ion-Atom Collisions**
Charge transfer cross sections of $Ne^{+}$ and $Ne^{++}$ in rare gases, 7:1398
Excitation and ionization of He by the impact of fast, complex ions. Asymptotic energy and charge state dependence, 7:1422
Spectral shapes of the molecular autoionization caused by $Li^{+}$ + He collisions at energies lower than 1.1 keV, 7:1404
Theoretical study of electron spectra ejected by molecular autoionization in He + $He^{2+}$ collision, 7:1423
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
**Thermodynamic Activity**
Thermodynamic analyses of impure helium for HTGR material testing, 7:820
**Uses**
Use of helium in uranium exploration, Grants district, 7:149
**HELIUM 3**
**Positronium**
Positron-induced cluster and positronium bubble in low temperature helium, 7:1437
**HELIUM 3 TARGET**
**Electron Reactions**
Experimental study on the (e,e'p) reactions with helium isotopes, 7:1566 (KFTI—79-48)
**Photonuclear Reactions**
Complete photodisintegration of three- and four-particle nuclei, 7:1563 (KFTI—79-48)
**HELIUM 4**
*See also HELIUM II*
**Positronium**
Positron-induced cluster and positronium bubble in low temperature helium, 7:1437
**HELIUM 4 TARGET**
**Cross Sections**
Electron quasi-free scattering by atomic nuclei in the interaction time approximation, 7:1560 (KFTI—79-48)
**Electron Reactions**
Exchange internucleon interactions in deep inelastic electron scattering by nuclei, 7:1565 (KFTI—79-48)
Experimental study on the (e,e'p) reactions with helium isotopes, 7:1566 (KFTI—79-48)
Theory of electroproduction of small relative momentum nucleon pairs on atomic nuclei, 7:1561 (KFTI—79-48)
**Photonuclear Reactions**
Complete photodisintegration of three- and four-particle nuclei, 7:1563 (KFTI—79-48)
Mechanism of three-particle photodisintegration of $^{4}$He, 7:1564 (KFTI—79-48)
Role of meson currents in the complete photodisintegration of $^{4}$He nucleus, 7:1562 (KFTI—79-48)

**HELIUM II**
**Excitation**
Quasiparticle and excitation energies of a condensed model bose system, 7:1441 (INIS-mf—6084)
**HELIUM IONS**
**Ion-Atom Collisions**
Autoionization in multiply-charged ion-atom collisions, 7:1425
Measurements of double differential cross sections for electrons ejected by 5 - 20 keV $H^+$, $H_2^+$ and $He^+$ impacts on argon, 7:1405
Multiple k-shell ionization of fluorine by hydrogen and helium ion impacts, 7:1403
Theoretical study of electron spectra ejected by molecular autoionization in He + $He^{2+}$ collision, 7:1423
**Ion-Ion Collisions**
Charge transfer in proton-hydrogenlike ion collision in a modified coulomb-born approximation, 7:1419
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
Charge transfer cross sections of $He^+$ and $Ne^+$ in carbon-containing molecules, 7:1417
**HELIUM METHOD**
*See ISOTOPE DATING*
**HEMATITE**
**Oxidation**
Tertiary oxidation in Westwater Canyon member of Morrison formation, 7:1262
**HEMOLYSIS**
**Biological Radiation Effects**
Studies of radiation induced hemolysis of erythrocytes, 7:1144 (INIS-mf—6531)
**HEMORRHAGE**
**Diagnosis**
Diagnostic and therapeutic value of angiography in gastro-intestinal surgical stump haemorrhages, 7:1090
**HEPATITIS**
**Antibodies**
Practical application of hepatitis B antigen and antibody determination by RIA in transfusion services, 7:1064 (INIS-mf—6419)
**Antigens**
Practical application of hepatitis B antigen and antibody determination by RIA in transfusion services, 7:1064 (INIS-mf—6419)
**HEREDITARY DISEASES**
**Radiosensitivity**
Human genetic disorders showing sensitivity to DNA-damaging agents. Strategies for future studies, 7:1166 (INIS-mf—6531)
**HIGH-LEVEL RADIOACTIVE WASTES**
**Leaching**
Influence of surface processes in waste form leaching, 7:214
**HIGH-TEMPERATURE GAS-COOLED REACTOR**
*See HTGR TYPE REACTORS*
**HINKLEY POINT-B REACTOR**
**Coolants**
Radiolytic oxidation of methane in commercial advanced gas cooled reactors, 7:841
Sulphur ingress into Hinkley Point 'B' AGR and its effect on carbon monoxide oxidation, 7:368
**HOLLANDITE**
**Calcination**
Calcination studies on perovskite, zirconolite, barium hollandite and SYNROC-B, 7:675
**HOLMIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**HOT CELLS**
**Decontamination**
Decontamination techniques suitable for post-irradiation examination caves, 7:846
**Design**
Modern design for $\alpha$ $\beta$ $\gamma$ active handling facilities for chemical research and development, 7:868
**Electron Microscopy**
Evolution of the equipment and recent developments in the alpha, beta, gamma-laboratory of the European Institute for Transuranium Elements, 7:875
**Maintenance**
Refurbishing of a cave line at Berkeley Nuclear Laboratories, 7:865
**Manipulators**
Remote handling and viewing for the future, 7:870
**Modifications**
Recent improvements in facilities for gamma-scanning and other non-destructive examinations of irradiated materials at ECN's hot cell plant L.S.O., 7:873
Refurbishing of the hot cell Celimene for the post-irradiation examination of PWR assemblies, 7:864
Renovations of beta-gamma hot cells for materials studies at CRNL, 7:863
**Radiation Protection**
Advanced design concepts for post-irradiation examination facilities, 7:869
**Remote Handling Equipment**
In-cell refabrication of experimental fuel rods using rods pre-irradiated in a power reactor, 7:507
**Remote Viewing Equipment**
Optical devices for remote examination, 7:882
**Servomechanisms**
Advanced manipulator system for large hot cells, 7:867
**Shielding**
Portable $10^4$ curie shielded cell, 7:862
**Specifications**
Comprehensive post-irradiation examination of power reactor fuels and core component materials, 7:880
Fuel element and materials hot laboratory in Beijing, 7:881
Hot cell installation for biaxial creep and burst testing of cladding specimens, 7:883
Method of study applied to safety of post-irradiation facilities, 7:879
PFR reprocessing plant cave, 7:866
Portable $10^4$ curie shielded cell, 7:862
Recent developments in post-irradiation examination techniques at Harwell, 7:878
**HOT LABS**
Postirradiation handling and examination at the HFEF complex, 7:887
**HOUSES**
**Energy Efficiency**
Adoption of energy conservation features in new homes: current practices and proposed policies, 7:637 (PAS—349)
**HTGR TYPE REACTORS**
*See also THTR-300 REACTOR*
**Coated Fuel Particles**
Determination of end-of-life failure fraction of HTGR-fuel particles by post-irradiation annealing and beta-autoradiography, 7:352
Experimental verification of stress model calculations for HTR fuel particles, 7:169
Irradiation performance assessment of coated particle fuels using the IMGA system, 7:349
Statistical methods for predicting failure probability of coated particles, 7:170
Stress performance calculations as a guide for layout and testing of coated fuel particles for HTRs, 7:171
**Containment Buildings**
Seismic response comparisons for an embedded high temperature gas-cooled reactor (HTGR) on a high seismic site, 7:592
**Coolants**
Role of adsorption processes in gas graphite reactions in high temperature gas-cooled reactors, 7:360

**Fuel Elements**
Gamma scanning of full scale HTR fuel elements, 7:351
Investigation of the activity release from HTR fuel element spheres during storage, 7:355
**Heat Exchangers**
Design of heat exchangers for high-temperature reactors, 7:377
**Moderators**
Role of adsorption processes in gas graphite reactions in high temperature gas-cooled reactors, 7:360
**Pressure Vessels**
Aspects on the design of modern PCRV with respect to the HHT-vessel, 7:371
Characteristics of the PCRV of the HHT demonstration plant, 7:374
Characteristics of the prestressed concrete reactor vessel of the HHT demonstration plant, 7:332 (IWGHTR—2)
Development and testing of a liner venting system, 7:555 (IWGHTR—2)
Feasibility of a multicavity PCPV with elastic hot liner for HTR, 7:373
HTR applications of the Austrian PCPV, 7:337 (IWGHTR—2)
Multicavity PCPVs for HTR and GCFR systems, 7:336 (IWGHTR—2)
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.1. Design of the multi-cavity prestressed concrete reactor vessel with warm liner, 7:333 (IWGHTR—2)
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.2. Three-dimensional analysis of the temperature and stress fields in a HHT vessel, including effects of the thermal creep, 7:334 (IWGHTR—2)
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.3. Experimental studies on the behaviour of concrete and liner at high temperature, 7:335 (IWGHTR—2)
Seismic response comparisons for an embedded high temperature gas-cooled reactor (HTGR) on a high seismic site, 7:592
**Primary Coolant Circuits**
High temperature alloys for the primary circuit of a prototype nuclear process heat plant, 7:380
**Reactor Cores**
Two-dimensional vibration test and its simulation analysis for a horizontal slice model of HTGR core, 7:378
**Reactor Materials**
3-D inelastic analysis of HTR graphite structures and a comparison with A 2-D approach, 7:432
Elastic plastic fracture toughness values for a Hastelloy alloy sample submitted to a static load, 7:689
Life prediction of simple structures subject to cyclic primary and secondary loading resulting in creep and platicity, 7:379
**Reactor Safety**
Proceedings of the second US-Japan seminar on HTGR safety technology, 1. General; accident delineation; helium technology, 7:601
Proceedings of the second US-Japan seminar on HTGR safety technology, 1. Material properties and design methods; seismic research, 7:602
**Reactor Vessels**
Parametric study on ligament stresses in multi-cavity prestressed concrete reactor vessels (PCRV's), 7:372
**Spent Fuel Elements**
Apparatus for fission gas release measurements from HTGR fuel elements at very high temperatures, 7:356
**Thermal Insulation**
Thermal insulation of the high-temperature helium-cooled reactors, 7:338 (IWGHTR—2)

**HUMAN CELLS**
*See ANIMAL CELLS*

**HUMAN POPULATIONS**
**Dose Commitments**
Application of the concept of collective dose commitment in environmental monitoring selection of significant radionuclides, 7:1041 (IAEA-TECDOC—229)
Radionuclide accumulation in selected components of the aquatic fauna of the Czechoslovak Danube River section, 7:1042 (IAEA-TECDOC—229)
**Dose Equivalents**
RA-226 collective dosimetry for surface waters in the uranium mining region of Pocos de Caldas (Doses to body organs of population), 7:1190
**Dose Limits**
Protection of the public and environment, 7:539
**Radiation Doses**
Two decades of research in the Brazilian areas of high natural radioactivity, 7:1189
**Radiation Protection Laws**
Approach to the derivation of radionuclide intake limits for members of the public, 7:1188

**HUMIC ACIDS**
**Precipitation**
Effects of ground-water flow on the origin of Colorado Plateau-type uranium deposits, 7:105

**HUNTERSTON-B REACTOR**
**Pressure Vessels**
Surveillance of prestressed concrete pressure vessels under commissioning and operational conditions at Hunterston 'B' Power Station, 7:370

**HUTTONITE**
**Physical Radiation Effects**
Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation, 7:718
Metamictization by heavy ion bombardment of α-quartz, zircon, monazite and nitride structures (3 MeV ion beams), 7:719

**HYBRID REACTORS**
**Design**
Engineering design of the SOLASE-H laser fusion hybrid reactor, 7:1685

**HYDRATES**
**Latent Heat Storage**
Thermal storage in salt-hydrates, 7:268

**HYDROCORTISONE**
**Radioimmunoassay**
Radioisotope diagnosis in vitro in clinical examinations. Chapter 10, 7:1101

**HYDROGEN**
**Diffusion**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
Radiation-enhanced permeation of $H_2$ in stainless steel, 7:658
**Dissociation**
Non equilibrium dissociation rates of diatomic species. A comparison between numerical and analytical methods, 7:1470
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
**Quantitative Chemical Analysis**
Sodium sampling and impurities determination, 7:741 (INIS-mf—6423)
**Radiolysis**
Carbon formation processes relevant to advanced carbon dioxide-cooled reactors, 7:357
**Turbulent Heating**
Collision dominated electron distribution function with turbulent heating in the $H_2$ plasma, 7:1466

**HYDROGEN 2**
*See DEUTERIUM*

**HYDROGEN 3**
*See TRITIUM*

**HYDROGEN IONS**
*See also HYDROGEN IONS 1 MINUS*
*HYDROGEN IONS 1 PLUS*
*HYDROGEN IONS 2 PLUS*
**Ion Sources**
Properties and discharge mechanisms of a saddle-field ion source, 7:1391
**Ion-Atom Collisions**
Multiple k-shell ionization of fluorine by hydrogen and helium ion impacts, 7:1403

**HYDROGEN IONS 1 MINUS**
**Duoplasmatrons**
Yield of negative ions from the duoplasmatron plasma, 7:1439

**HYDROGEN IONS 1 PLUS**
**Collisions**
Electron capture and loss to, or from wake-riding states by fast ions in metals, 7:1418
Inner shell ionization in the collision system of $Z_1 << Z_2$, 7:1401
K, L and M shell ionizations in the energy region E/lambda U > 1, 7:1400
**Ion-Atom Collisions**
Alignment of ions after L- and M-shell ionization by proton impact, 7:1426
Measurements of double differential cross sections for electrons ejected by 5 - 20 keV $H^+$, $H_2^+$ and $He^+$ impacts on argon, 7:1405
**Ion-Ion Collisions**
Charge transfer in proton-hydrogenlike ion collision in a modified coulomb-born approximation, 7:1419
**HYDROGEN IONS 2 PLUS**
**Ion-Atom Collisions**
Measurements of double differential cross sections for electrons ejected by 5 - 20 keV $H^+$, $H_2^+$ and $He^+$ impacts on argon, 7:1405
**HYDROGEN ISOTOPES**
**Mass Spectroscopy**
Hydrogen isotope analysis by low resolution mass spectrometry, 7:766
New automated mass spectrometer for high precision isotope ratio determinations of gases, 7:785
**HYDROGEN LOGS**
*See NEUTRON-GAMMA LOGGING*
*NEUTRON-NEUTRON LOGGING*
**HYDROGEN PHOSPHATES**
*See PHOSPHORIC ACID*
**HYDROLOGY**
**Meetings**
Arid zone hydrology. Investigations with isotope techniques, 7:1031
**HYDROXY ACIDS**
*(For CARBOXYLIC ACIDS only.)*
**Radiosensitivity Effects**
Para-hydroxybenzoic acid and a hypoxic radiosensitizer in bacterial cells, 7:1191
**HYDROXYL RADICALS**
**Chemical Reaction Kinetics**
Kinetics of the reactions of the hydroxyl radical with xylenes, 7:831
**HYPERFRAGMENTS**
*See HYPERNUCLEI*
**HYPERNUCLEI**
**Binding Energy**
A-nucleon potential and binding energy of the hypertriton, 7:1625 (TRI—79-1)
Qualitative discussion of the A=4 hypernuclear isodoublet, 7:1626 (TRI—79-1)
**Excited States**
Excited states in light hypernuclei from $(K^-,\pi^-)$ reactions, 7:1580 (TRI—79-1)
**Gamma Spectra**
Possible observation of a $\gamma$-transition in the $\Lambda^8$Li hypernucleus, 7:1581 (TRI—79-1)
**Lambda Particles**
$\Lambda$ and $\Sigma$ hyperons in nuclei, 7:1530 (IPNO-TH—80-49)
**Sigma Particles**
$\Lambda$ and $\Sigma$ hyperons in nuclei, 7:1530 (IPNO-TH—80-49)
**Strangeness**
$(K^-,\pi^-)$ strangeness exchange reaction on $^6$Li, $^7$Li, and $^9$Be, 7:1579 (TRI—79-1)
Search for $\Sigma$ hypernuclei by means of the strangeness-exchange reactions $(K^-,\pi^-)$ and $(K^-,\pi^+)$, 7:1582 (TRI—79-1)
**HYPERONS**
*See also LAMBDA PARTICLES*
**Quantum Chromodynamics**
Hyperon physics and chromodynamics, 7:1531 (TRI—79-1)
**HYPERTHYROIDISM**
**Diagnosis**
Triiodothyronine RIA using endogenous antibody. Clinical experience, 7:1067 (INIS-mf—6419)
**Radiotherapy**
Changes in the level of thyrotropic hormones of hypophysis of radioiodinetherapy of thyrotoxicosis, 7:1103
Changes in thrombelastographic indices in patients with thyrotoxicosis treated with radioactive iodine, 7:1242
**HYPOPHYSIS**
*See PITUITARY GLAND*
**HYPOTHYROIDISM**
**Diagnosis**
Triiodothyronine RIA using endogenous antibody. Clinical experience, 7:1067 (INIS-mf—6419)

## I

**IGNEOUS ROCKS**
*See also BASALT*
*GRANITES*
*VOLCANIC ROCKS*
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**ILLINIUM**
*See PROMETHIUM*
**IMMUNE REACTIONS**
**Biological Radiation Effects**
Formation of autohemolysins in radiotherapy of oncologic patients, 7:1239
**IN CORE INSTRUMENTS**
*(See also specific instruments.)*
**Dielectric Track Detectors**
Neutron emission observed from spent thermal reactor fuel assemblies, 7:293 (EUR—6813(Vol.2))
**INCIDENTS**
*See ACCIDENTS*
**INCLUSIVE DISTRIBUTION**
*See DISTRIBUTION*
**INCOLOY 800**
**Corrosion**
Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys, 7:683
Effect of liquid sodium on behaviour of selected structural materials for steam generators of fast power reactors, 7:648 (INIS-mf—6423)
**Corrosion Resistance**
Corrosion resistance of Ni and Mo coated super alloy in He-high temperature environment, 7:682
**INCONEL 617**
**Corrosion**
Corrosion of inconel 617 in simulated HTGR helium environment, 7:684
**INCONEL ALLOYS**
*See also INCONEL 617*
**Corrosion**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**INDIUM**
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**Spectroscopy**
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**INDIUM COMPLEXES**
**Enthalpy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**Entropy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**Free Energy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815

**INDIUM SULFIDES**
**Electric Conductivity**
Electrical resistivity of I indium sulphides (InS) crystals down to 4.2deg K and upto 80 kilobar, 7:1654
**INDUCTORS**
*See SOLENOIDS*
**INDUSTRIAL PLANTS**
**Meetings**
Gas chemistry in nuclear reactors and large industrial plant, 7:842
**INDUSTRIAL SECTOR**
*See INDUSTRY*
**INDUSTRY**
*See also CHEMICAL INDUSTRY*
*NUCLEAR INDUSTRY*
**Civil Liability**
Legal advantages for those complying with technical standards, 7:1715
Standards and producers' liability, 7:1713
**Standardization**
Legal advantages for those complying with technical standards, 7:1715
**INJURIES**
*See also BONE FRACTURES*
*WOUNDS*
**Radiosensitivity Effects**
RNA biosynthesis in rabbit skeletal muscles in case of combined radiation injury, 7:1222
**INNER-SHELL IONIZATION**
**Bremsstrahlung**
Inner shell ionization accompanied by electron bremsstrahlung, 7:1412
**INSULIN**
**Radioimmunoassay**
Radioisotope diagnosis in vitro in clinical examinations. Chapter 10, 7:1101
**INTERACTING BOSON MODEL**
**Eigenstates**
Intrinsic state for the interacting boson model and its relationship to the Bohr-Mottelson model, 7:1628
**Group Theory**
Microscopic structure and group theory of the interacting boson model, 7:1627
**INTERMEDIATE MASS NUCLEI**
**Giant Resonance**
Electric and magnetic giant resonances of low multipolarity studied with inelastic electron scattering ($^{11}$B, $^{16}$C, $^{16}$O, $^{28}$Si, sup(40, 42, 44, 48)Ca, $^{58}$Ni, $^{90}$Ir, $^{140}$Ce and $^{208}$Pb isotopes), 7:1556 (JINR-D—4-80-385)
**Hadron Reactions**
Particle interactions with nuclei in the energy range of 0.1-5 TeV, 7:1568
**INTERNAL CONTAMINATION**
*See RADIONUCLIDE KINETICS*
**INTERPLANETARY MAGNETIC FIELDS**
**Magnetic Field Configurations**
Large-scale magnetic field structure at the Earth's orbit, its correlation with solar activity and orientation and motion of the solar system in the Galaxy, 7:1314
**Variations**
Interplanetary response to solar long time-scale phenomena, 7:1303
Structure of the neutral sheet of the interplanetary magnetic field according to measurements of cosmic ray intensity and anisotropy, 7:1282 (INIS-mf—6385)
**INTERPLANETARY SPACE**
**Computerized Simulation**
Global modeling of disturbances in the corona-interplanetary space, 7:1363
Physical processes and models of interplanetary responses: suggested theoretical studies, 7:1356
**Cosmic Ray Propagation**
Propagation in the interplanetary space of solar cosmic rays produced in solar flares at longitudes of 46-48 deg in September-November 1973, 7:1278 (INIS-mf—6290)
**Radiowave Radiation**
Interplanetary scintillation - preliminary observations at 103 MHz, 7:1352
IPS observations of flare-generated disturbances (Interplanetary scintillation), 7:1353
Large decametric wavelength antenna array for IPS observations of radio sources (Interplanetary scintillation), 7:1351
Observations of interplanetary scintillation and a theory of high-speed solar wind, 7:1362
**Shock Waves**
Theoretical interpretation of traveling interplanetary phenomena and their solar origins, 7:1355
Two-fluid theory of interplanetary shock waves, 7:1342
**Solar Wind**
Transient phenomena originating at the Sun - an interplanetary view, 7:1344
**Velocity**
Observations of interplanetary scintillation and a theory of high-speed solar wind, 7:1362
**INTOR TOKAMAK**
**Vacuum Systems**
Calculation model and design principles of the demonstration Tokamak-reactor vacuum system, 7:1679
**INVERSE SCATTERING PROBLEM**
*(Problem of determining scattering potential from phase shifts.)*
**Analytical Solution**
Exact solution of the inverse scattering problem at fixed energy, 7:1553 (INIS-mf—6479)
**IODEX PROCESS**
*See IODOX PROCESS*
**IODINE**
**Corrosive Effects**
Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys, 7:683
**IODINE 125**
**Radiation Hazards**
Radiation risks from $^{125}$I in RIA laboratories - internal contamination and burden to hands, 7:1243 (INIS-mf—6419)
**IODINE 131**
**Buildup**
Iodine accumulating activity of thyroid autoplastic graft in the early period after subtotal resection of thyroid, 7:1107
**Diffusion**
Diffusion of cesium in concrete, 7:210
**Distribution Functions**
Diffusion of cesium in concrete, 7:210
**Sorption**
Diffusion of cesium in concrete, 7:210
**IODINE ISOTOPES**
**Radiotherapy**
Comparative evaluation of treatment of patients with syringomyelia with X-rays and radioactive iodine, 7:1236
Thrombelastographic indices in patients with syringomyelia treated with radioactive iodine, 7:1241
**IODOX PROCESS**
Iodine removal in the Purex reprocessing process, 7:220
**ION BLOCKING**
*See ION CHANNELING*
**ION CHANNELING**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)
**Computerized Simulation**
Theoretical investigations of deviations from statistical equilibrium in planar channeling, 7:1639
**ION COLLISIONS**
*See also ION-ATOM COLLISIONS*
**Distribution Functions**
Iterative method for computing velocity distribution functions of low-concentration particle components in a given non-uniform background, 7:1472
**ION IMPLANTATION**
Design criteria for ion implantation equipment for surface treatment, 7:676
New dose control technique for ion implantation, 7:1388
**Calibration Standards**
Low concentration spectroscopic standards by ion implantation, 7:768
**ION SOURCES**
*See also DUOPLASMATRONS*

*ELECTRON BEAM ION SOURCES*
*PENNING ION SOURCES*
**Beam Production**
Design criteria for ion implantation equipment for surface treatment, 7:676
High-current ion implanter for industrial use, 7:1387
**Electric Discharges**
Experimental determination of the stable working region of a 15 cm-diameter RF-ion source 'RIT 15', 7:1438
Properties and discharge mechanisms of a saddle-field ion source, 7:1391
**Electron Cyclotron-Resonance**
Electron cyclotron resonance source for heavy multiply charged ions, 7:1390
**Field Emission**
Liquid metal field-emission ion sources and their applications, 7:1392
**Ion Implantation**
New dose control technique for ion implantation, 7:1388
**Oscillations**
Properties and discharge mechanisms of a saddle-field ion source, 7:1391
**Oscillators**
Optimum design of the electrostatic electron oscillator, 7:1440
**ION-ATOM COLLISIONS**
**Charge Exchange**
Charge exchange with multicharged ions in slow collisions. Translation factors in a quantum mechanical formulation, 7:1413
**Energy-Level Transitions**
Rotationally induced transitions in atomic collisions, 7:1424
**Inner-Shell Ionization**
Correlated two-electron transitions into doubly-ionized K-shell, 7:1407
Inner shell ionization accompanied by electron bremsstrahlung, 7:1412
Theory of inner-shell vacancy formation in superheavy quasimolecules, 7:1409
**Spin Orientation**
Alignment and orientation in atomic collisions, 7:1421
**Total Cross Sections**
Rotationally induced transitions in atomic collisions, 7:1424
**IONIC CRYSTALS**
**Crystal Defects**
Defect modelling, 7:647 (AERE-TP—843)
**Crystal Models**
Polarisable dipole models for ionic solids and their quantum mechanical justification, 7:735
**IONIZATION CHAMBERS**
*See also FISSION CHAMBERS*
**Calibration**
Calibration of radiation protection instruments at SSDL level in Israel, 7:959
**Radiation Monitors**
Secondary standard dosimetry system with automatic dose/rate calculation, 7:952
**Specifications**
Secondary standard dosimetry system with automatic dose/rate calculation, 7:952
**IONIZED GASES**
**Boltzmann Equation**
Relation between mobility and diffusion in swarms, 7:1469
**Magnetic Fields**
Partially ionized gas in a travelling high frequency magnetic field, 7:1461
**IONIZING RADIATIONS**
**Biological Radiation Effects**
In vivo study of effects of ionizing radiation in rabbit ear chambers, 7:1160 (INIS-mf—6531)
Study of chromosome aberration yield in human lymphocytes as an indicator of radiation dose, 7:1170 (INIS-mf—6531)
**Mutagenesis**
How real is the environmental mutagenesis threat, 7:1165 (INIS-mf—6531)
**Risk Assessment**
How real is the environmental mutagenesis threat, 7:1165 (INIS-mf—6531)
**Synergism**
Analytical approach to the comparison of chemical and radiation hazards to man, 7:1200
Combined carcinogenic effects of ionizing radiation and chemical molecules, 7:1197
**IONOPHORESIS**
*See ELECTROPHORESIS*
**IONOSPHERE**
*See also D REGION*
**Ion Density**
Middle atmosphere ionized component, 7:1381 (ESA-SP—152)
**IRELAND**
**Natural Gas Fields**
Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland, 7:57
**IRISH SEA**
**Natural Gas Fields**
Geology of the Morecambe gas field, 7:56
**Seismic Surveys**
Structure and stratigraphy of the Kish Bank Basin, 7:48
**IRON**
**Corrosion**
Carbon deposition on iron and steel surfaces, 7:659
Metallographic investigation into interaction of cesium with some metals, 7:701
**Ion-Atom Collisions**
Contribution of electron transfer to K-shell ionizations by $N^{7+}$-ion bombardment, 7:1415
**Spectrophotometry**
Plutonium analysis. Iron spectrophotometric determination, 7:792 (CEA-CETAMA—7)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**IRON ALLOYS**
**Corrosion**
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**Phase Stability**
Effect of small fourth-element alloying additions on the calculated phase stability in the Fe-Cr-Ni system, 7:672
**IRON COMPLEXES**
**Solubility**
Aqueous complexes of metal ions present in the reprocessing of nuclear fuels. Complexes with the ligands orthophenanthroline and dibutyl phosphate, 7:850
**IRON OXIDES**
*See also HEMATITE*
*LIMONITE*
*MAGNETITE*
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**IRRIGATION**
**Optimization**
Some aspects in relation to the efficient use of soils, water and fertilizers in Egypt, 7:1126 (IAEA-TECDOC—236)
**ISOMERIZATION**
*See CHEMICAL REACTIONS*
**ISOTOPE DATING**
**Accuracy**
How accurate is the $^{14}C$ method, 7:1263
**ISOTOPE EFFECTS**
Use of electromigration method in physicochemical investigations. Chapter 4, 7:823
**ISOTOPE RATIO**
**Mass Spectroscopy**
New computerized mass spectrometer for isotopic analyses of solids, 7:786
**ISRAEL**
**Fallout Deposits**
Radioactive fallout in Israel 1976-1978, 7:986 (IA—1356)

**Radiation Protection Laws**
Occupational radiation protection legislation in Israel, 7:632
**ISRAELI ORGANIZATIONS**
**Dosemeters**
Calibration of radiation protection instruments at SSDL level in Israel, 7:959

## J

**J-3105 RESONANCES**
*See PSI-3105 RESONANCES*
**JABILUKA DEPOSIT**
Ground water geochemistry in the vicinity of the Jabiluka deposits, 7:99
**Geology**
Geologic setting of the East Alligator uranium deposits and prospects, 7:69
Mercury distribution in the Jabiluka Two orebody and its host rocks, 7:1273
**Isotope Dating**
Rb-Sr chronology of micas at Jabiluka, 7:1261
**Isotope Ratio**
Fluid inclusion and oxygen isotope studies of the Nabarlek and Jabiluka uranium deposits, Northern Territory, Australia, 7:76
Lead isotope studies at Jabiluka, 7:80
Stable isotope study of three deposits in the Alligator Rivers Uranium Field, N.T., 7:77
**Mineralization**
Origin of uranium mineralization at Jabiluka, 7:85
**Mineralogy**
Mineralogy of the Jabiluka, Ranger, Koongarra and Nabarlek uranium deposits, 7:75
**JAERI**
*(Japanese Atomic Energy Research Institute.)*
**Hot Cells**
Comprehensive post-irradiation examination of power reactor fuels and core component materials, 7:880
**Spent Fuel Elements**
Neutron radiographic techniques in post-irradiation examination, 7:944
**JAPAN**
**Geology**
Geoscientific evaluation of radioactive waste isolation in Japan, 7:198
**Radioactive Waste Disposal**
Geoscientific evaluation of radioactive waste isolation in Japan, 7:198
**Radioactive Waste Processing**
Bituminization of low-level liquid waste, 7:208
**JAPAN ATOMIC ENERGY RESEARCH INSTITUTE**
*See JAERI*
**JAPAN ATR FUGEN**
*See JATR REACTOR*
**JAPAN FAST EXPERIMENTAL BREEDER REACTOR**
*See JOYO REACTOR*
**JAPANESE ATOMIC ENERGY RESEARCH INSTITUTE**
*See JAERI*
**JASTROW THEORY**
**Many-Body Problem**
Nuclear many-body theories, 7:1632
**JATR REACTOR**
**Power-Cooling-Mismatch Accidents**
Semi-empirical evaluation studies on PCMI for the Fugen fuel rod, 7:551 (IWGFPT—7)
**Primary Coolant Circuits**
Field vibration test results and design for reactor coolant piping systems of ATR 'Fugen', 7:597
**JENSEN SARCOMA**
*See EXPERIMENTAL NEOPLASMS*
**JET MODEL**
**Hadron-Hadron Interactions**
Angular flow of charge and energy in hadron hadron collisions, 7:1511
**JET REACTORS**
**Bellows**
Mechanical static analysis of JET vacuum vessel, 7:1700
**JFER REACTOR**
*See JOYO REACTOR*
**JORDAN**
**Hydrology**
Aspects of the environmental isotope chemistry in groundwaters in Eastern Jordan, 7:1023
**JOYO REACTOR**
**Shielding**
Application of cross section sensitivity analysis to 'JOYO' main shield, 7:416

## K

**KALKAR POWER REACTOR**
*See SNR-1 REACTOR*
**KALPAKKAM LMFBR REACTOR**
**Molten Metal-Water Reactions**
Evaluation of design pressure for the F.B.T.R. secondary sodium heat transfer system and its components in case of a leak in steam generator, 7:605
**Secondary Coolant Circuits**
Evaluation of design pressure for the F.B.T.R. secondary sodium heat transfer system and its components in case of a leak in steam generator, 7:605
**KAON MINUS REACTIONS**
**Y*Resonances**
Kaon-nucleus interactions, 7:1502 (TRI—79-1)
**KAON MINUS-PROTON INTERACTIONS**
**Cross Sections**
Meson production in $K^-$ p interactions at 70 GeV/C, 7:1494
**Particle Production**
Production of large Psub(T) single particles and multiparticle systems (jets) in $K^-$ p interactions at 110 GeV/c, 7:1490
**KAON PLUS REACTIONS**
**Elastic Scattering**
Neutron density studies through $K^+$-nucleus scattering, 7:1503 (TRI—79-1)
**KAON PLUS-PROTON INTERACTIONS**
**Elastic Scattering**
Analysis of elastic scattering in the method of the generalized matrix of reactions, 7:1481 (JINR-D—2-11707)
**KAON REACTIONS**
**Elastic Scattering**
Kaon elastic and inelastic scattering at 800 MeV/c, 7:1483 (TRI—79-1)
**Inelastic Scattering**
Kaon elastic and inelastic scattering at 800 MeV/c, 7:1483 (TRI—79-1)
**Nuclear Structure**
Nuclear physics with kaons, 7:1484 (TRI—79-1)
**KAON-NUCLEON INTERACTIONS**
*See also KAON-PROTON INTERACTIONS*
Nuclear physics with kaons, 7:1484 (TRI—79-1)
**Cross Sections**
Neutron density studies through $K^+$-nucleus scattering, 7:1503 (TRI—79-1)
**Elastic Scattering**
Measurement of $K^{+-}$-nucleus elastic scattering at forward angles. An experiment to be done at KEK, 7:1485 (TRI—79-1)
**N-1520 Resonances**
Kaon-nucleus interactions in the Λ(1520) region, 7:1504 (TRI—79-1)
**KAON-PROTON INTERACTIONS**
**Inclusive Interactions**
Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**KAONS**
**Particle Production**
Meson production in $K^-$ p interactions at 70 GeV/C, 7:1494

**KENYA**
**Agriculture**
Soil erosion, fertility and water conservation factors in agricultural activities in Kenya: A look at problems and efforts being made to solve them using radioisotope techniques, 7:1128 (IAEA-TECDOC—236)
**KERNKRAFTWERK OBRIGHEIM**
*See OBRIGHEIM REACTOR*
**KIDNEYS**
**Biological Functions**
Effective renal blod flow and canalicular function of kidneys with obliterating endarteritis, 7:1104
Radioisotopic renography in the evaluation of rehabilitation of children operated on the occasion of hydronephrosis, 7:1105
**Blood Flow**
Effective renal blod flow and canalicular function of kidneys with obliterating endarteritis, 7:1104
**Renography**
Angiographic renal embolization: indications and results, 7:1092
**KNOCK-ON ELECTRONS**
*See ELECTRONS*
**KOONGARRA DEPOSIT**
**Geology**
Geologic setting of the East Alligator uranium deposits and prospects, 7:69
**Isotope Ratio**
Movements of uranium and daughter isotopes in the Koongarra uranium deposit, 7:82
Stable isotope study of three deposits in the Alligator Rivers Uranium Field, N.T., 7:77
**Mineralogy**
Mineralogy of the Jabiluka, Ranger, Koongarra and Nabarlek uranium deposits, 7:75
**KOREA (SOUTH)**
*See REPUBLIC OF KOREA*
**KRYPTON**
**Ion Acoustic Waves**
Ion acoustic waves in noble gas ion lasers, 7:901
**KRYPTON 85**
**Radiation Monitoring**
Atmospheric dispersion study with $^{85}Kr$ and $SF_6$ gas, 7:993
Study and measurement of the atmospheric pollution by $^{85}Kr$, 7:992
**KUHFR REACTOR**
**Multiplication Factors**
RERTR/ANL-KURRI results and comparison on reduced enrichment for the KUHFR, 7:542 (KURRI-TR—192)
**Reactor Cores**
RERTR/ANL-KURRI results and comparison on reduced enrichment for the KUHFR, 7:542 (KURRI-TR—192)
**KWO REACTOR**
*See OBRIGHEIM REACTOR*
**KYOTO UNIVERSITY HIGH FLUX REACTOR**
*See KUHFR REACTOR*

## L

**LABYRINTH**
*See AUDITORY ORGANS*
**LAGRANGIAN FIELD THEORY**
**Gauge Invariance**
CPsup(N-1) model with unconstrained variables, 7:1533
**LAKES**
**Evaporation**
Determination by stable isotopes of underground inflow and outflow and evaporation of young artificial groundwater lakes, 7:1027
Tritium and helium-3 studies in Lake Constance, 7:1030
**Flow Rate**
Determination by stable isotopes of underground inflow and outflow and evaporation of young artificial groundwater lakes, 7:1027
**Hydrology**
Determination by stable isotopes of underground inflow and outflow and evaporation of young artificial groundwater lakes, 7:1027
Natural radon as a limnological tracer for the study of vertical and horizontal eddy diffusion, 7:1029
Whole lake tritium spikes to measure horizontal and vertical mixing rates, 7:1028
**Isotope Ratio**
Environmental isotope balance of Lake Kinneret as a tool in evaporation rate estimation, 7:1009
Tritium and helium-3 studies in Lake Constance, 7:1030
**Mixing**
Natural radon as a limnological tracer for the study of vertical and horizontal eddy diffusion, 7:1029
Tritium and helium-3 studies in Lake Constance, 7:1030
Whole lake tritium spikes to measure horizontal and vertical mixing rates, 7:1028
**Nitrogen Cycle**
Isotope studies of nitrogen transformations in Castle Lake, California, 7:1010
**LAMBDA NEUTRAL**
*See LAMBDA PARTICLES*
**LAMBDA PARTICLES**
**Semileptonic Decay**
Precise measurement of the ratio of the axial vector coupling to vector coupling in $A^0 \rightarrow p + e^- + \text{anti } \nu$, 7:1487
**LANDFILLS**
*See SANITARY LANDFILLS*
**LANTHANIDES**
*See RARE EARTHS*
**LANTHANUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Multi-Element Analysis**
Analysis of gamma-ray spectra. Chapter 3. Section 1, 7:748
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**LANTHANUM COMPLEXES**
**Solubility**
Aqueous complexes of metal ions present in the reprocessing of nuclear fuels. Complexes with the ligands orthophenanthroline and dibutyl phosphate, 7:850
**LASER FUSION REACTORS**
Advanced lasers for fusion, 7:1676
**Design**
Engineering design of the SOLASE-H laser fusion hybrid reactor, 7:1685
**Wall Loading**
Dynamic loading of the structural wall in a lithium fall fusion reactor, 7:1704
**LASER ISOTOPE SEPARATION**
Investigation of a high power tunable dye laser, 7:889
**LASER-PRODUCED PLASMA**
Experiment on development of high pressure laser plasma and absorption of laser, 7:1478
**Plasma Diagnostics**
X-ray laser gain measurements in laser produced plasmas, 7:1674 (INIS-mf—6424)
**LATENT HEAT OF FUSION**
*See FUSION HEAT*
**LATENT HEAT STORAGE**
Thermal storage in salt-hydrates, 7:268
**Phase Change Materials**
Thermodynamic basis for selecting heat storage materials, 7:269
**LATTICE DEFECTS**
*See CRYSTAL DEFECTS*
**LATTICES (CRYSTAL)**
*See CRYSTAL LATTICES*

**LAWRENCE LIVERMORE LABORATORY**
**Data Acquisition Systems**
LLNL nuclear chemistry automated production counting facilities: design and implementation, 7:1708
**LEACHING**
**Mathematical Models**
Influence of surface processes in waste form leaching, 7:214
**LEAD**
**Bremsstrahlung**
Internal and external bremsstrahlung spectra in thick lead and aluminium targets excited by soft beta rays, 7:1643
**Internal Bremsstrahlung**
Internal and external bremsstrahlung spectra in thick lead and aluminium targets excited by soft beta rays, 7:1643
**Ion-Atom Collisions**
Positron production in heavy ion collisions, 7:1411
Theory of inner-shell vacancy formation in superheavy quasimolecules, 7:1409
**Isotope Dating**
Internal isochrone method in accessory zircon dating, 7:1271
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**LEAD IONS**
**Ion-Ion Collisions**
K-Mo-radiation in heavy ion collisions, 7:1410
**LEAD ISOTOPES**
**Mass Spectroscopy**
Mass spectrometric determination of lead isotopes in West German pit coal, 7:1
**LEAD METHOD**
*See ISOTOPE DATING*
**LEAD SULFIDES**
**Ion Channeling**
Channeling in thin lead sulphide films, 7:1644
**LEAK DETECTORS**
Continuous analyzers of hydrogen and carbon in liquid sodium and of hydrocarbon total in protective atmosphere above sodium, 7:405 (INIS-mf—6423)
**LEGAL ASPECTS**
**Meetings**
Technical standardization and law. Papers and discussions, 7:430
**LEPTON-HADRON INTERACTIONS**
**Deep Inelastic Scattering**
Gluon jet effects in deep inelastic lepton-hadron collisions, 7:1537
**LEPTON-NUCLEON INTERACTIONS**
*See also DEEP INELASTIC SCATTERING*
QCD-tests in lepton nucleon scattering experiments, 7:1535
**LEPTONS**
*See also ELECTRONS*
*NEUTRINOS*
**Diagrams**
Leptons, quarks and hadrons in a same theoretical approach, 7:1527 (IPNO-TH—80-49)
**Pair Production**
Production of lepton pairs at the ISR, 7:1497
**LEUKOCYTES**
*See also LYMPHOCYTES*
**Chromosomal Aberrations**
Analysis of chromosomal aberrations of leukocytes of peripheric blood in patients with depression of different genesis hematopoiesis, 7:1219
**LEVEL INDICATORS**
Continuous level gauge for horizontal cylindrical vessels, 7:932 (IA—1356)
Portable nuclear level gauge using a neutron source, 7:931 (IA—1356)
**LIBYA**
**Geology**
Isotope investigations as a tool for regional hydrogeological studies in the Libyan Arab Jamahiriya, 7:1020
**Ground Water**
Geochemical and isotopic approach to recharge evaluation in semi-arid zones: past and present, 7:1014
**Hydrology**
Groundwater flow patterns in the western Libyan Arab Jamahiriya evaluated from isotopic data, 7:1021
Isotope investigations as a tool for regional hydrogeological studies in the Libyan Arab Jamahiriya, 7:1020
Recharge of groundwaters in arid areas. Case of the Djeffara plain in Tripolitania, Libyan Arab Jamahiriya, 7:1022
**LI-DRIFTED GE DETECTORS**
Real time operation of a multiple gamma measurement installation, 7:946
**LI-DRIFTED SI DETECTORS**
**Neutron Dosimetry**
Fast neutron fluence measurements with the Nb-93(n,n')Nb-93m reaction and the application to long-term irradiations, 7:930 (EUR—6813(Vol.2))
**LIGHT NUCLEI**
**Giant Resonance**
Electric and magnetic giant resonances of low multipolarity studied with inelastic electron scattering ($^{11}$B, $^{16}$C, $^{16}$O, $^{28}$Si, sup(40, 42, 44, 48)Ca, $^{58}$Ni, $^{90}$Ir, $^{140}$Ce and $^{208}$Pb isotopes), 7:1556 (JINR-D—4-80-385)
**Hadron Reactions**
Particle interactions with nuclei in the energy range of 0.1-5 TeV, 7:1568
**Photonuclear Reactions**
Instructiveness of spectra for photodisintegration products of light nuclei, 7:1573 (KFTI—79-48)
**LIGHT WATER BREEDER REACTORS**
*See LWBR TYPE REACTORS*
**LIMONITE**
**Oxidation**
Tertiary oxidation in Westwater Canyon member of Morrison formation, 7:1262
**LINERS**
**Design**
Analysis and design of containment liner/anchorage system, 7:330
**Stress Analysis**
Analysis and design of containment liner/anchorage system, 7:330
**Thermal Testing**
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.3. Experimental studies on the behaviour of concrete and liner at high temperature, 7:335 (IWGHTR—2)
**LIQUID METAL FAST BREEDER REACTORS**
*See LMFBR TYPE REACTORS*
**LIQUID METAL TEST FACILITIES**
*See TEST FACILITIES*
**LIQUID METALS**
**Ion Sources**
Liquid metal field-emission ion sources and their applications, 7:1392
**LIQUID SCINTILLATORS**
**Decontamination**
Decontamination and modification of liquid scintillators, 7:960
**LITHIUM**
**Activation Analysis**
Neutron counting in activation analysis. Chapter 3. Section 3, 7:750
**Chemical Reactions**
Compatibility of molten salts with type 316 stainless steel and lithium, 7:678
**Crystal Models**
Unified study of static and dynamic properties of alkali metals, 7:687
**Self-Diffusion**
Self-diffusion study of lithium in molten salt related to molten breeder reactor, 7:428
**LITHIUM 6 TARGET**
**Electron Reactions**
Influence of dynamic correlations and of nuclear structure effects on the form factors of excitation of light nuclei by fast electrons, 7:1571 (KFTI—79-48)

Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48)
**Kaon Minus Reactions**
($K^-,\pi^-$) strangeness exchange reaction on $^6$Li, $^7$Li, and $^9$Be, 7:1579 (TRI—79-1)
Excited states in light hypernuclei from ($K^-,\pi^-$) reactions, 7:1580 (TRI—79-1)
**Photonuclear Reactions**
Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV, 7:1576 (KFTI—80-6)
Study of the ($\gamma$, $\pi^0$p) reaction of $^6$Li, $^{12}$C and $^{16}$O nuclei in a wide range of transferred momentum, 7:1574 (KFTI—80-6)

**LITHIUM 7 TARGET**
**Electron Reactions**
Influence of dynamic correlations and of nuclear structure effects on the form factors of excitation of light nuclei by fast electrons, 7:1571 (KFTI—79-48)
Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48)
**Kaon Minus Reactions**
($K^-,\pi^-$) strangeness exchange reaction on $^6$Li, $^7$Li, and $^9$Be, 7:1579 (TRI—79-1)
Excited states in light hypernuclei from ($K^-,\pi^-$) reactions, 7:1580 (TRI—79-1)

**LITHIUM DEUTERIDES**
**Crystal Models**
Quadrupolar deformation of the electronic charge cloud and the lattice mechanics of LiH-LiD crystals, 7:710
**Dissociation Energy**
Experimental study of gaseous lithium deuterides and lithium oxides. Implications for the use of lithium and $Li_2O$ as breeding materials in fusion reactor blankets, 7:1680
**Electronic Structure**
Quadrupolar deformation of the electronic charge cloud and the lattice mechanics of LiH-LiD crystals, 7:710

**LITHIUM HYDRIDES**
**Crystal Models**
Quadrupolar deformation of the electronic charge cloud and the lattice mechanics of LiH-LiD crystals, 7:710
**Electronic Structure**
Quadrupolar deformation of the electronic charge cloud and the lattice mechanics of LiH-LiD crystals, 7:710

**LITHIUM IONS**
**Ion-Atom Collisions**
Excitation and ionization of He by the impact of fast, complex ions. Asymptotic energy and charge state dependence, 7:1422
Spectral shapes of the molecular autoionization caused by $Li^+$ + He collisions at energies lower than 1.1 keV, 7:1404
**Ion-Ion Collisions**
Charge transfer in proton-hydrogenlike ion collision in a modified coulomb-born approximation, 7:1419

**LITHIUM ISOTOPES**
**Isotope Ratio**
Isotopic analysis of lithium, boron and magnesium and their importance in nuclear technology, 7:780

**LITHIUM OXIDES**
**Evaporation**
Experimental study of gaseous lithium deuterides and lithium oxides. Implications for the use of lithium and $Li_2O$ as breeding materials in fusion reactor blankets, 7:1680

**LITHIUM-SULFUR BATTERIES**
**Battery Charging**
Mathematical modeling of the lithium-aluminum, iron sulfide battery. 2. The influence of relaxation time on the charging characteristics, 7:610
**Performance**
Mathematical modeling of the lithium-aluminum, iron sulfide battery. 1. Galvanostatic discharge behavior, 7:609

**LIVER**
**Biological Functions**
Peculiarities of liver affection in chronic alcoholic intoxication according to the data of radioisotopic and biochemical study methods, 7:1116
**Biomedical Radiography**
Arterial therapeutic angiography in liver pathology, 7:1091
**Scintiscanning**
Diagnostic value of radioisotopic methods of study in liver diseases, 7:1100
Peculiarities of liver affection in chronic alcoholic intoxication according to the data of radioisotopic and biochemical study methods, 7:1116

**LIVER CIRRHOSIS**
**Diagnosis**
Diagnostic value of radioisotopic methods of study in liver diseases, 7:1100

**LIXIVIATION**
*See LEACHING*

**LMFBR TYPE REACTORS**
*See also KALPAKKAM LMFBR REACTOR*
*PHENIX REACTOR*
*SNR-1 REACTOR*
*SUPER PHENIX REACTOR*
**Boilers**
BESBET 2 - a computer code for the simulation of severe transients in LMFBR boilers, 7:423
**Cover Gas**
Performance of a cryogenic distillation system for purifying the argon cover gas in a fast reactor, 7:427
**Electromagnetic Pumps**
Electromagnetic induction pumps for liquid sodium, 7:402 (INIS-mf—6423)
Testing induction pumps on KAS I facility and problems of safety of work in testing plant, 7:403 (INIS-mf—6423)
**Fire Hazards**
Certain aspects of operation safety of nuclear power plants, 7:547 (INIS-mf—6423)
**Fuel Assemblies**
Simulating thermodynamic effects in liquid sodium reactor facilities using electrically heated fuel element mock-ups, 7:400 (INIS-mf—6423)
Technological research of components and materials using UJV sodium stand, 7:399 (INIS-mf—6423)
**Fuel Pellets**
Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors, 7:419
**Heat Exchangers**
IHX design for pool type LMFBR system application, 7:417
**Hydrodynamics**
Hydrodynamic stability tests and analytical model development for once-through sodium heated steam generator, 7:420
**Planning**
Technical and economic aspects of sodium cooled nuclear facilities, 7:396 (INIS-mf—6423)
**Radioactive Waste Management**
Management of sodium-bearing transuranic waste and scrap materials, 7:192
**Reactor Components**
Evaluation of void swelling in irradiated L.M.F.B.R. components by density measurement, 7:414
**Reactor Control Systems**
Use of distributed micro processors for sodium pre-heating system, 7:530 (AECL—7056)
**Reactor Instrumentation**
Continuous analyzers of hydrogen and carbon in liquid sodium and of hydrocarbon total in protective atmosphere above sodium, 7:405 (INIS-mf—6423)
Instrument for monitoring activity in liquid sodium, 7:404 (INIS-mf—6423)
**Reactor Materials**
Equipment for long-term testing of material creep in liquid sodium, 7:398 (INIS-mf—6423)
**Steam Generators**
Continuous analyzers of hydrogen and carbon in liquid sodium and of hydrocarbon total in protective atmosphere above sodium, 7:405 (INIS-mf—6423)
Dynamic analyses and control systems for steam generators in LMFBRs, 7:424
High reliability straight tube LMFBR steam generator design, 7:418
Hydrodynamic stability tests and analytical model development for once-through sodium heated steam generator, 7:420
**Test Facilities**
Design of surface heating of experimental sodium facility at VUHZ Dobra, 7:401 (INIS-mf—6423)
Problems of building sodium test circuit at VUZES, 7:397 (INIS-mf—6423)

Testing induction pumps on KAS I facility and problems of safety of work in testing plant, 7:403 (INIS-mf—6423)
**LOCAL GALAXY**
*See MILKY WAY*
**LOSS OF COOLANT**
**Fluid-Structure Interactions**
Analysis of the RS16B experiment on fluid-structure interactions during PWR blowdown, 7:581
Calculations on the HDR core barrel response during snapback tests, 7:584
Coupled fluid-structure analysis of the core barrel behaviour during blowdown, 7:583
Fluid-structure interactions in PWR vessels during blowdown. Code development at Karlsruhe and results, 7:579
MEL finite element analysis of water-shell interactions in the context of a PWR-LOCA, 7:580
**Fuel Cans**
MABEL-2. A code to analyze cladding deformation in a loss-of-coolant accident: status, 7:552 (IWGFPT—7)
**Fuel Element Failure**
Development of a burst criterion for Zircaloy fuel cladding under LOCA conditions, 7:550 (IWGFPT—7)
**Hydraulics**
Model of countercurrent steam-water flow in large horizontal pipes (PWR), 7:557
**Two-Phase Flow**
Model of countercurrent steam-water flow in large horizontal pipes (PWR), 7:557
**LOW-LEVEL RADIOACTIVE WASTES**
**Radiation Monitoring**
Study of devices for the non destructive examination of drums containing low activity waste by neutron transport and gamma radiation codes (APPOLO), 7:236 (EUR—6629)
**LUMINOUS PAINTS**
**Radiation Monitoring**
Simple method for collection of HTO from air, 7:955
**LUNGS**
**Biomedical Radiography**
Intervention radiology in pulmonary thrombo-embolic disease (PTED), 7:1093
**Delayed Radiation Effects**
Inhalation of radon and its daughter products. Doses and pathological effects, 7:1201
**LUTETIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**LWBR TYPE REACTORS**
**Fuel Cycle**
Sensitivity of light water reactor fuel cycle parameters and costs to uncertainties in thermal nuclear data and methods, 7:407
**LYMPH NODES**
**Morphological Changes**
Structural and functional change peculiarities in immunocompetent organs during radiation injury in animals treated with αZ-macroglobulin, 7:1223
**LYMPHOCYTES**
**Biological Radiation Effects**
Response of cultured mouse lymphoid cell lines to x-irradiation, 7:1145 (INIS-mf—6531)
**Chromosomal Aberrations**
Study of chromosome aberration yield in human lymphocytes as an indicator of radiation dose, 7:1170 (INIS-mf—6531)
**LYMPHOID CELLS**
*See LYMPHOCYTES*
**LYSINE**
**Biological Radiation Effects**
Effect of gamma irradiation on the lysine content of plants, 7:1141 (INIS-mf—6050)

# M

**MA 754**
*See NICKEL BASE ALLOYS*
**MAGNESIUM**
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**MAGNESIUM CHLORIDES**
**Solvent Properties**
$SrCl_2$ solubility in complex brines, 7:814
**MAGNESIUM COMPOUNDS**
**Entropy**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**Specific Heat**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**MAGNESIUM ISOTOPES**
**Isotope Ratio**
Isotopic analysis of lithium, boron and magnesium and their importance in nuclear technology, 7:780
SIMS measurements of magnesium isotopic abundance ratio in the Allende carbonaceous chondrite, 7:1289
**MAGNESIUM SILICATES**
**Redox Reactions**
Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses, 7:201
**MAGNET COILS**
**Composite Materials**
Applications of metallic composites in the magnet system of a demonstration fusion reactor, 7:1681
**Shape**
Method for determining the magnet shape in toroidal arrangements, 7:1692
Structural analysis of non-circular coils for fusion experiments, 7:1693
**Stress Analysis**
Structural analysis of non-circular coils for fusion experiments, 7:1693
**MAGNETIC COILS**
*See MAGNET COILS*
**MAGNETIC FIELDS**
*See also INTERPLANETARY MAGNETIC FIELDS*
**Biological Radiation Effects**
Changes in morphological and cytochemical indices of peripheral blood in white rats following combined effect of permanent magnetic field and ionizing radiation, 7:1228
**MAGNETIC MIRROR TYPE REACTORS**
**Planning**
Mirror fusion reactor design, 7:1683
**MAGNETITE**
**Solubility**
Thermodynamics of magnetite solubilization in basic medium, 7:816
**MAGNETOHYDRODYNAMIC CHANNELS**
*See MHD CHANNELS*
**MAGNETOHYDRODYNAMIC GENERATORS**
*See MHD GENERATORS*
**MAGNETRONS**
**Electric Discharges**
Modified magnetron discharge facility, 7:1456
**MAGNOX TYPE REACTORS**
*See also CALDER HALL A-1 REACTOR*
*CALDER HALL A-2 REACTOR*
*CALDER HALL B-3 REACTOR*
*CALDER HALL B-4 REACTOR*
*CHAPELCROSS-1 REACTOR*
*CHAPELCROSS-2 REACTOR*
*CHAPELCROSS-3 REACTOR*
*CHAPELCROSS-4 REACTOR*

**Corrosion Inhibitors**
Behaviour of hydrogenous compounds in reactor coolants, 7:366
**Fuel Elements**
Role of PIE in the development of the Magnox fuel element in the UK, 7:342
**Nuclear Fuels**
Computer data processing systems used in the assessment of Magnox and AGR fuel performance, 7:347
**Spent Fuel Elements**
Review of non-destructive testing techniques employed by the CEGB for the post-irradiation examination of Magnox and CAGR fuel, 7:346

**MAIZE**
**Biological Radiation Effects**
Effect of gamma irradiation on the lysine content of plants, 7:1141 (INIS-mf—6050)

**MALIGNANCIES**
*See NEOPLASMS*

**MAMMARY GLANDS**
**Biomedical Radiography**
New device for isometric localization of nonpalpable breast lesions detected by mammography. Experience in over 100 cases, 7:1097
Problems of image quality, radiation burden and risk/benefit ratio in mammography, 7:1244 (INIS-mf—6421)
**Carcinomas**
Diagnosis of bone metastases in breast carcinoma by isotope technique with abbreviated recording, 7:1113 (INIS-mf—6421)
**Inflammation**
Experiment on radiotherapy of postnatal mastitis, 7:1237
**X Radiation**
Experiment on radiotherapy of postnatal mastitis, 7:1237

**MAN**
*See also WOMEN*
**Radiation Hazards**
Natural background as an indicator of radiation-induced cancer, 7:1194
**Radiosensitivity**
Studies of DNA repair and chromosome aberrations in two unusual DNA repair deficient individuals, 7:1149 (INIS-mf—6531)

**MANGANESE**
**Activation Analysis**
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**Ion Collisions**
K$\beta$/K$\alpha$ intensity ratios and energy shifts of K$\beta$ rays produced by N-ion impact, 7:1399
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)

**MANUFACTURING FACILITIES**
*See INDUSTRIAL PLANTS*

**MANY-BODY PROBLEM**
Nuclear many-body theories, 7:1632

**MARCOULE PHENIX REACTOR**
*See PHENIX REACTOR*

**MARINE DISPOSAL**
**International Laws**
Legal provisions concerning the handling and disposal of radioactive waste in international and national law, 7:223
**Monitoring**
Environmental monitoring and deep ocean disposal of packaged radioactive waste, 7:222

**MARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*

**MARINE VEHICLE ACCIDENTS**
*See ACCIDENTS*

**MASS SPECTROMETERS**
Analytical procedures using instruments in the post-irradiation examination of fuels, 7:285
Automation of stable isotope analysis, 7:789
New automated mass spectrometer for high precision isotope ratio determinations of gases, 7:785
New computerized mass spectrometer for isotopic analyses of solids, 7:786
**Modifications**
Modification of an A-DIDA secondary ion mass spectrometer to allow the examination of $\alpha$- and $\beta/\gamma$-emitting specimens, 7:945
**Specifications**
New thermal ionisation mass spectrometer, 7:788
TSN 206 SA thermal ionisation mass spectrometer and its applications to Oklo natural fossil reactor studies, 7:787
**Uses**
New thermal ionisation mass spectrometer, 7:788
TSN 206 SA thermal ionisation mass spectrometer and its applications to Oklo natural fossil reactor studies, 7:787

**MASS SPECTROSCOPY**
**Calibration Standards**
Low concentration spectroscopic standards by ion implantation, 7:768
**Sample Preparation**
Mass spectrometry, 7:763
**Uses**
Application of thermal ionization mass spectrometry in nuclear technology, 7:779

**MASSACHUSETTS INSTITUTE TECHN. ALCATOR**
*See ALCATOR DEVICE*

**MATERIALS**
*See also BUILDING MATERIALS*
*FERROELECTRIC MATERIALS*
*PHASE CHANGE MATERIALS*
*POROUS MATERIALS*
**Mathematical Models**
Tensor function approach to constitutive equations of inelasticity, 7:1662
**Mechanical Properties**
Mechanical behavior of materials, 7:640
**Meetings**
Mechanical behavior of materials, 7:640
**Performance**
Introduction to Solar Materials Science, 7:261
**Plasticity**
Order, heat, intrinsic dissipation and inelastic analysis, 7:1663
Tensor function approach to constitutive equations of inelasticity, 7:1662
**Stress Analysis**
Order, heat, intrinsic dissipation and inelastic analysis, 7:1663

**MATERIALS (FERROELECTRIC)**
*See FERROELECTRIC MATERIALS*

**MATERIALS TESTING**
*See also NONDESTRUCTIVE TESTING*
**Data Acquisition Systems**
Automatic data collection in PIE, 7:340

**MAXWELL-BOLTZMANN EQUATION**
*See BOLTZMANN EQUATION*

**MEA**
*(Aminoethanethiol.)*
**Dissolution**
Sustained release of radioprotective agents in vitro, 7:1199

**MECHANICAL STRUCTURES**
*See also BELLOWS*
**Damage**
Material damage in structural analysis, 7:466
**Failures**
Structural collapse due to plastic instability, 7:462
**Fatigue**
Inelastic analysis of structures with applications to cyclic loadings, 7:464
**Mechanical Properties**
High-temperature design of elastic-plastic structures, 7:463
**Plasticity**
Inelastic analysis of structures with applications to cyclic loadings, 7:464

**Response Functions**
Numerical methods for engineering, 7:571
**Stress Analysis**
Shakedown analysis by finite element incremental procedures, 7:1668
Simplified methods in inelastic analysis, 7:465
**MEDICAL EXAMINATIONS**
**Radionuclide Administration**
Portable device for the measurement of regional cerebral blood flow in the ICU and Or using Cd Te detectors and a fourier transform based data analysis, 7:1087
**MEDICAL SUPPLIES**
**Radiosterilization**
Application of combined ultraviolet and gamma-radiation effect for medical instruments sterilization, 7:1138 (INIS-mf—5673)
Gamma-rays and ethylene oxide sterilization. Abstract 226, 7:1178
Some theoretical problems of biological evaluation of medical polymer articles sterilized with radiation, 7:1140 (INIS-mf—5673)
**MEDICINES**
*See DRUGS*
**MELEKESS-SM-2 REACTOR**
*See SM-2 REACTOR*
**MELTDOWN**
*See also CORIUM*
Interaction of molten 'corium' with concrete in a hypothetical LWR core-melt-down accident. Oxidation of core materials and hydrogen production, 7:562
**Fluid-Structure Interactions**
Influence of gas generation on melt/concrete interactions, 7:561
**MENTAL DISORDERS**
**Epidemiology**
Epidemiological follow-up research within a geographically stable population, 7:1119
**MERCAMINE**
*See MEA*
**MERCAPTOALANINE-BETA**
*See CYSTEINE*
**MERCAPTOETHYLAMINE**
*See MEA*
**MERCURY**
**Ecological Concentration**
Mercury distribution in the Jabiluka Two orebody and its host rocks, 7:1273
**Electric Arcs**
Current densities in anchored cathode spots of a dc mercury vacuum arc, 7:1452
**Weakly Ionized Gases**
Study of the dense weakly ionized mercury plasma by the method of molecular dynamics, 7:1476
**MERCURY IONS**
**Ion Sources**
Experimental determination of the stable working region of a 15 cm-diameter RF-ion source 'RIT 15', 7:1438
**MERCURY TELLURIDES**
**Recombination**
Recombination in narrow-gapped semiconductors, 7:712 (INIS-mf—6449)
**MESOCRICETUS**
*See HAMSTERS*
**MESON SPECTROSCOPY**
Meson spectra, 7:1501 (TRI—79-1)
**MESONS**
**Bethe-Salpeter Equation**
Confrontation of geometrodynamics with experiment, 7:1548
**Particle Decay**
Phenomenological model for Cabibbo favoured charmed meson decays into three pseudoscalars: Psub(c) → PPP, 7:1507
**METABOLISM**
**Delayed Radiation Effects**
Postoperative hypoparathyroidism followed by Parkinsonium, 7:1174
**Dynamic Function Studies**
Comparison of bone resorption and bone-blood calcium equilibrium in vertebrates, 7:1081
**METAL VAPOR LASERS**
**Electric Discharges**
Experimental investigation of the pulse discharge in Cu + Ne mixture in high repetition rate regime, 7:894
**Electron Temperature**
Electron energy distribution function for copper vapour, 7:893
**Metastable States**
Peculiarities of electric discharges in mixtures of metal vapors and rare gases at increased pressures, 7:895
**Population Inversion**
Inversion of excited atom states in cesium and nitrogen-cesium plasma, 7:896
Inversion of the atomic level population densities in low temperature alkali plasma, 7:897
**Pulses**
Connection of the copper vapour laser emission pulse characteristics with plasma parameters, 7:892
**METALLURGY**
*(Use of a more specific term is recommended; see also EXTRACTIVE METALLURGY or FABRICATION.)*
**Meetings**
Complex metallurgy '78, 7:160
**METAL-NONMETAL BATTERIES**
*See also LITHIUM-SULFUR BATTERIES*
**Electrodes**
Reactions of FeS electrodes in LiCl-KCl electrolyte, 7:608
**Electrolytes**
Reactions of FeS electrodes in LiCl-KCl electrolyte, 7:608
**METALS**
*See also ACTINIDES*
*ALKALI METALS*
*ALKALINE EARTH METALS*
*LIQUID METALS*
*RARE EARTHS*
*TRANSITION ELEMENTS*
**Crystal Defects**
Defect modelling, 7:647 (AERE-TP—843)
**Emissivity**
Emissivity of metals, 7:265
**Ion Implantation**
Design criteria for ion implantation equipment for surface treatment, 7:676
**Ion Microprobe Analysis**
Enhanced negative secondary ion emission with cesium ion bombardment, 7:685
**Mathematical Models**
Emissivity of metals, 7:265
**Mechanical Properties**
Mechanical behavior of materials, 7:640
**Meetings**
Mechanical behavior of materials, 7:640
**Mineralization**
Stratigraphy of the Kapalga Formation north of Pine Creek and its relationship to base metal mineralization, 7:72
**Physical Radiation Effects**
Radiation damage in metals, 7:646 (AERE-TP—843)
**Plasticity**
Damage postulate for nonproportional cyclic plasticity, 7:694
**Radiant Heat Transfer**
Emissivity of metals, 7:265
**Surface Treatments**
Design criteria for ion implantation equipment for surface treatment, 7:676
**METAMORPHIC ROCKS**
**Age Estimation**
Internal isochrone method in accessory zircon dating, 7:1271
**Temperature Measurement**
Oxygen isotope geothermometry on high-grade metamorphic rocks, 7:1275
**METASTASES**
**Diagnosis**
Diagnosis of bone metastases in breast carcinoma by isotope technique with abbreviated recording, 7:1113 (INIS-mf—6421)

**Radiotherapy**
Transaxillary intra-arterial treatment of hepatic metastases with cytostatics and embolization: its control by isotope studies, 7:1177

**METHANE**
**Diffusion**
Calculation of methane profiles in graphite structures, 7:722
**Gas Flow**
Drainage of methane from the solid at West Cliff Colliery. Part 1. Optimization of drainage hole design parameters, 7:8
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
Charge transfer cross sections of $He^+$ and $Ne^+$ in carbon-containing molecules, 7:1417
**Radiolysis**
Carbon formation processes relevant to advanced carbon dioxide-cooled reactors, 7:357
Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839
Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
Radiolytic oxidation of methane in commercial advanced gas cooled reactors, 7:841
Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358
Trace organics in AGR coolants, 7:367

**MEXICO**
**Hydrology**
Study of the leakage between two aquifers in Hermosillo, Mexico, using environmental isotopes, 7:1018

**MHD CHANNELS**
**Forced Convection**
Heat transfer by a developing magnetohydrodynamic flow with Hall and ion slip currents, 7:1480
**Heat Transfer**
Heat transfer by a developing magnetohydrodynamic flow with Hall and ion slip currents, 7:1480

**MHD GENERATORS**
**Plasma Diagnostics**
Electron and positive-ion measurements in MHD combustion plasmas with phosphorous addition (Ethanol fuel), 7:634

**MICA**
**Isotope Dating**
Rb-Sr chronology of micas at Jabiluka, 7:1261

**MICE**
**Dose-Response Relationships**
RBE of $\alpha$-particles versus $\beta$-particles in bone sarcoma induction, 7:1185
**Radionuclide Kinetics**
Subcellular distribution of $^{239}Pu$ in the liver of rat, mouse, Syrian and Chinese hamster, 7:1183

**MICROBIAL FLORA**
*See MICROORGANISMS*

**MICROFLORA**
*See MICROORGANISMS*

**MICROORGANISMS**
*See also PROTOZOA*
**Radiosterilization**
Comparative assessment of methods of determination of initial sowing and contaminant radiosensitivity, 7:1137 (INIS-mf—5673)

**MICROSEISM**
*See SEISMIC NOISE*

**MIGRATION (RADIONUCLIDE)**
*See RADIONUCLIDE MIGRATION*

**MILKY WAY**
**Brightness**
Balloon observation of the galaxy australis in Australia, 7:1369
**Gamma Spectra**
Balloon observation of galactic gamma-ray lines, 7:1368

**MILLISEC LIVING RADIOISOTOPES**
**Activation Analysis**
Measurement of very short-lived nuclides. Chapter 3. Section 4, 7:751

**MILLSTONE-3 REACTOR**
**On-Line Control Systems**
Northeast Utilities generic plant computer system, 7:534 (AECL—7056)

**MINE-MOUTH GENERATING PLANTS**
*See COAL MINES*
*FOSSIL-FUEL POWER PLANTS*

**MINERAL WASTES**
**Shear Properties**
Design of a large field shear box, 7:10

**MINERS**
**Health Hazards**
Hazards to the health of uranium workers and the regional population, 7:239
**Neoplasms**
Inhalation of radon and its daughter products. Doses and pathological effects, 7:1201

**MIRRORS**
**Cleaning**
Effect of soiling on solar mirrors and techniques used to maintain high reflectivity, 7:264
**Contamination**
Effect of soiling on solar mirrors and techniques used to maintain high reflectivity, 7:264
**Spectral Reflectance**
Effect of soiling on solar mirrors and techniques used to maintain high reflectivity, 7:264

**MIXED OXIDE FUEL FABRICATION PLANTS**
**Containment Systems**
Basic design requirements for the containment system of a mixed oxide fuel fabrication plant, 7:168

**MIXED OXIDE FUELS**
**Fabrication**
Considerations on a sol-gel type process as a fuel fabrication route for the actinide recycle, 7:163 (EUR—6929)
**Performance**
Performance of mixed oxide fuel at high burnup and comparison with $UO_2$ fuel, 7:500 (IWGFPT—8)
**Performance Testing**
PCI performance of $PuO_2$-$UO_2$ fuels irradiated in water reactors, 7:505 (IWGFPT—8)

**MIXERS**
**Design**
Bituminization of low-level liquid waste, 7:208

**MODELS (NUCLEAR)**
*See NUCLEAR MODELS*

**MODELS (OPTICAL)**
*See OPTICAL MODELS*

**MODELS (SHELL)**
*See SHELL MODELS*

**MOESSBAUER SPECTROMETERS**
**Timing Circuits**
Constant velocity Moessbauer spectrometer free of long-term instrumental drifts in the count rate, 7:969

**MOISTURE**
*See also WATER*
**Remote Sensing**
Remote assessment of soil moisture, 7:1124 (IAEA-TECDOC—236)

**MOLECULAR IONS**
*See also HYDROGEN IONS 2 PLUS*
**Nuclear Reaction Yield**
Evaluation of the molecular ion yield in nuclear fragmentation experiments, 7:1619 (KFTI—79-40)

**MOLECULAR STRUCTURE**
**Meetings**
Molecular physics and quantum chemistry: into the 80's, 7:1397

**MOLTEN SALTS**
**Corrosive Effects**
Compatibility of molten salts with type 316 stainless steel and lithium, 7:678

**MOLYBDENUM**
**Corrosion Resistance**
Corrosion resistance of Ni and Mo coated super alloy in He-high temperature environment, 7:682
**Electron Spectroscopy**
ESCA investigation of molybdenum containing silicate and phosphate glasses, 7:200

**Heat Treatments**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Metallurgical Effects**
Corrosion behaviour of Ni-Re, Ni-Re-Mo, Ni-Re-Hf, Ni-Re-W-Hf alloys, 7:686
**Oxidation**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Permeability**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Physical Radiation Effects**
The ductility in bending of molybdenum alloys irradiated between 425 and 1000 C, 7:680
**Spectroscopy**
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)

**MOLYBDENUM ALLOYS**
*See also HASTELLOYS*
*MOLYBDENUM BASE ALLOYS*
**Corrosion**
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681

**MOLYBDENUM BASE ALLOYS**
*See also ILLOY-TZM*
**Physical Radiation Effects**
The ductility in bending of molybdenum alloys irradiated between 425 and 1000 C, 7:680

**MONAZITES**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**Physical Radiation Effects**
Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation, 7:718
Geologic stability of monazite and its bearing on the immobilization of actinide wastes, 7:720
Metamictization by heavy ion bombardment of α-quartz, zircon, monazite and nitride structures (3 MeV ion beams), 7:719
**Stability**
Geologic stability of monazite and its bearing on the immobilization of actinide wastes, 7:720
**Weathering**
Geologic stability of monazite and its bearing on the immobilization of actinide wastes, 7:720

**MONITORS (REACTOR)**
*See REACTOR CONTROL SYSTEMS*

**MONOCRYSTALS**
**Electron Channeling**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)
**Ion Channeling**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)
**Positron Channeling**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)
**Proton Channeling**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)

**MONTMORILLONITE**
**Sorptive Properties**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216

**MORAINES**
**Sorptive Properties**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216

**MORDENITE**
**Comparative Evaluations**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209

**MUCOPROTEINS**
**Biological Radiation Effects**
Serum-mucoid fraction content in development of skin acute radiation necrosis in rats, 7:1224
**Metabolism**
Metabolism breakage of non-collagenous proteins and skin ultrastructure of rats in case of its local radiation acute injury, 7:1225
Relation of mucoprotein metabolism with radiosensitivity of rat organism exposed to ultraviolet radiation, 7:1205

**MUCOSA**
*See MUCOUS MEMBRANES*

**MUCOUS MEMBRANES**
**Membrane Transport**
Ionized calcium concentrations in Krebs-Ringer bicarbonate buffers (KRBB) and their effect on mineral transport across intestinal mucosa and placenta, 7:1079

**MULTICHARGED IONS**
**Ion Sources**
Electron cyclotron resonance source for heavy multiply charged ions, 7:1390
**Penning Ion Sources**
Improvement of multiply charged ion production for pulsed duoplasmatron of duoPIGatron, 7:1393

**MULTI-ELEMENT ANALYSIS**
**Uses**
Forensic applications. Chapter 5. Section 6, 7:760

**MULTIWIRE PROPORTIONAL CHAMBERS**
*See also DRIFT CHAMBERS*
**Cosmic X-Ray Sources**
HXR80M-balloon experiment: a microprocessor-controlled transatlantic payload, 7:948
**Hard X Radiation**
HXR80M-balloon experiment: a microprocessor-controlled transatlantic payload, 7:948
**Performance**
Multiwire proportional and drift chambers: from first principles to future prospects, 7:941 (RL—80-043)
**Specifications**
Multiwire proportional and drift chambers: from first principles to future prospects, 7:941 (RL—80-043)

**MUNICIPAL WASTES**
**Briquetting**
Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge, 7:638 (NYSERDA—81-6)
**Waste Disposal**
Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge, 7:638 (NYSERDA—81-6)

**MUON PAIRS**
**Pair Production**
Evidence for scale breaking of the pion structure function, 7:1499

**MUSCLES**
*See also MYOCARDIUM*
**Radionuclide Kinetics**
Dynamics of Cs-137 distribution in the muscle tissue of swine by single and repeated contamination, 7:1202

**MUTAGENS**
**Mutagenesis**
Mutagenesis by technetium-99 and by chemicals, 7:1168 (INIS-mf—6531)
**Synergism**
Analytical approach to the comparison of chemical and radiation hazards to man, 7:1200

**MUTANTS**
**Genotype**
Genetic characterisation of radiation-sensitive mutations of the slime mould Dictyostelium discoideum, 7:1154 (INIS-mf—6531)
**Radiosensitivity**
Repair and actio spectrum of oxygen-independent lethality of near uv light on Haemophilus influenzae and lack of mutation, 7:1204

**MUTATIONS**
*See also CHROMOSOMAL ABERRATIONS*

**Radioinduction**
Mechanisms of radiation induced mutability in bacteria, 7:1157 (INIS-mf—6531)
Plasmid modification of spontaneous and radiation-induced mutability in Pseudomonas aeruginosa, 7:1158 (INIS-mf—6531)
**MYOCARDIUM**
**Ontogenesis**
Activity of $^{32}P$ inclusion and content of adenylic system components in myocardium of growing rats at $\beta$-adrenergetic block, 7:1082
Activity of $^{32}P3$ inclusion and glycogen content in rat myocardium following alpha-adrenergic blockade, 7:1120
**MYXEDEMA**
*See HYPOTHYROIDISM*
**MYXOMYCETES**
**Mutations**
Genetic characterisation of radiation-sensitive mutations of the slime mould Dictyostelium discoideum, 7:1154 (INIS-mf—6531)
**Radiosensitivity**
Genetic characterisation of radiation-sensitive mutations of the slime mould Dictyostelium discoideum, 7:1154 (INIS-mf—6531)

## N

**NABARLEK DEPOSIT**
**Geology**
Geologic setting of the East Alligator uranium deposits and prospects, 7:69
**Isotope Ratio**
Fluid inclusion and oxygen isotope studies of the Nabarlek and Jabiluka uranium deposits, Northern Territory, Australia, 7:76
**Mineralogy**
Mineralogy of the Jabiluka, Ranger, Koongarra and Nabarlek uranium deposits, 7:75
**NATIONAL ACCELERATOR LABORATORY**
*See FERMILAB ACCELERATOR*
**NATURAL GAS**
**Prices**
California energy futures: a presentation made to the California Energy Commission, 7:628 (P—300-80-033)
**NATURAL GAS DEPOSITS**
**Cap Rock**
Study of the tightness of the rock cover of the Suchohrad-Gajary underground natural gas reservoirs using nuclear logging methods, 7:58 (INIS-mf—6422)
**Exploration**
Oils and source rocks of the North Sea area, 7:25
**NATURAL GAS FIELDS**
**Geologic History**
Frigg gas field, 7:55
**Geologic Models**
Refinement of the geological model of the Thistle Field, 7:38
**Geology**
Rotliegend gas fields of the K and L blocks, Netherlands Offshore (1968 to 1978): a case history, 7:54
**Offshore Operations**
Rotliegend gas fields of the K and L blocks, Netherlands Offshore (1968 to 1978): a case history, 7:54
**Reservoir Engineering**
Geological input to reservoir simulation of the Brent Formation, 7:37
Geology of the Morecambe gas field, 7:56
**Resource Development**
Frigg gas field, 7:55
Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland, 7:57
**Simulation**
Geological input to reservoir simulation of the Brent Formation, 7:37
**Stratigraphy**
Frigg gas field, 7:55
Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland, 7:57
Petroleum geology of the continental shelf of northwest Europe, 7:13
**NEODYMIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**NEODYMIUM PHOSPHATES**
**Phase Studies**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**NEON**
**Ion-Atom Collisions**
Charge transfer cross sections of $Ne^{+}$ and $Ne^{++}$ in rare gases, 7:1398
Dynamical effect on the ionization processes in ion-atom collisions, 7:1408
Recoil charge-state distributions resulting from small impact parameter collisions of F and O projectiles with Ne, 7:1408
Symmetric resonance electron transfer of multiply charged ions at low energies: A sup(+) + A → A + A sup(q+) (q <= 7), 7:1414
**NEON 20 REACTIONS**
**Nuclear Reaction Kinetics**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**NEON 22 REACTIONS**
**Nuclear Reaction Kinetics**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**NEON IONS**
**Ion-Atom Collisions**
Autoionization in multiply-charged ion-atom collisions, 7:1425
Charge transfer cross sections of $Ne^{+}$ and $Ne^{++}$ in rare gases, 7:1398
Dynamical effect on the ionization processes in ion-atom collisions, 7:1408
Symmetric resonance electron transfer of multiply charged ions at low energies: A sup(+) + A → A + A sup(q+) (q <= 7), 7:1414
**Ion-Molecule Collisions**
Charge transfer cross sections of $He^{+}$ and $Ne^{+}$ in carbon-containing molecules, 7:1417
**NEOPLASMS**
*See also CARCINOMAS*
*EXPERIMENTAL NEOPLASMS*
**Biopsy**
X-ray guided biopsy, 7:1096
**Chemotherapy**
Some changes in ultrastructure of bone marrow cells in its aplastic states, 7:1212
**Diagnosis**
New device for isometric localization of nonpalpable breast lesions detected by mammography. Experience in over 100 cases, 7:1097
**Epidemiology**
Evaluation of cancer incidence for Anglos in the period 1969-1971 in areas of census tracts with measured concentrations of plutonium soil contamination downwind from the Rocky Flats Plant in the Denver standard metropolitan statistical area, 7:1195
**Radiotherapy**
Some changes in ultrastructure of bone marrow cells in its aplastic states, 7:1212

Transcatheter embolization of renal neoplasms. A comparison of the merits of the radio-active infarct implant versus total embolization with inert material, 7:1176

**NEPTUNE PLANET**
**Albedo**
Correlated variations of planetary albedos and solar-interplanetary parameters, 7:1313

**NERVOUS SYSTEM DISEASES**
*See also MENTAL DISORDERS*
**Radiotherapy**
Comparative evaluation of treatment of patients with syringomyelia with X-rays and radioactive iodine, 7:1236
Thrombelastographic indices in patients with syringomyelia treated with radioactive iodine, 7:1241

**NETHERLANDS**
**Petroleum Deposits**
Habitat of the Rijswijk oil province, onshore, the Netherlands, 7:36
**Petroleum Geology**
Habitat of the Rijswijk oil province, onshore, the Netherlands, 7:36

**NEUTRINO BEAMS**
**Beam Shaping**
Super high-energy intense neutrino beam shaping, 7:909 (INIS-mf—6295)

**NEUTRINOS**
**Oscillations**
Oscillations of massless neutrinos as a refractive phenomenon, 7:1509

**NEUTRON DENSITY**
Neutron density studies through $K^+$-nucleus scattering, 7:1503 (TRI—79-1)

**NEUTRON DETECTORS**
*See also ACTIVATION DETECTORS*
*FISSION CHAMBERS*
*SELF-POWERED NEUTRON DETECTORS*
**Neutron Dosimetry**
Report on session L - Workshop on dosimetry techniques, 7:927 (EUR—6813(Vol.2))

**NEUTRON DOSIMETRY**
Report on session L - Workshop on dosimetry techniques, 7:927 (EUR—6813(Vol.2))
Thermoelectric neutron dosimetry: summary of recent results, 7:929 (EUR—6813(Vol.2))
**Meetings**
Review of session L: dosimetry techniques, 7:925 (EUR—6813(Vol.2))
**Spectra Unfolding**
Analysis and extension of the SAND-II code, 7:433 (EUR—6813(Vol.2))

**NEUTRON FLUX**
**Benchmarks**
Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2))
**Radiation Streaming**
Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2))

**NEUTRON RADIOGRAPHY**
Need for standardization in the field of neutron radiography, 7:943
Neutron radiographic techniques in post-irradiation examination, 7:944

**NEUTRON REACTIONS**
**Elastic Scattering**
First results in evaluation of neutron nuclear data for Si, 7:1585 (ZfK—410)
**Fission**
Fission barrier theory and its application to the calculation of actinide neutron cross-sections, 7:1614 (IAEA-SMR—43)
**Inelastic Scattering**
Absolute values of inelastic neutron scattering cross-sections calculated with account taken of the pre-equilibrium mechanism, 7:1612 (IAEA-SMR—43)
First results in evaluation of neutron nuclear data for Si, 7:1585 (ZfK—410)
**Resonance**
Applied neutron resonance theory, 7:1604 (IAEA-SMR—43)
**Statistical Models**
Parameter systematics for statistical theory calculations of neutron reaction cross-sections, 7:1609 (IAEA-SMR—43)

**NEUTRON SPECTRA**
**Spectra Unfolding**
Analysis and extension of the SAND-II code, 7:433 (EUR—6813(Vol.2))
Comparison of four neutron spectrum unfolding codes, 7:438 (EUR—6813(Vol.2))
Few-channel unfolding in shielding - the SENSAK code, 7:1638 (EUR—6813(Vol.2))
Many channel spectrum unfolding, 7:435 (EUR—6813(Vol.2))
Multialgorithm unfolding studies of neutron spectra from activation detectors, 7:437 (EUR—6813(Vol.2))
Several applications of J1 unfolding method of multiple foil data to reactor dosimetry, 7:436 (EUR—6813(Vol.2))
Unfolding by least-squares methods: SAND-II, STAY'SL, 7:434 (EUR—6813(Vol.2))

**NEUTRON SPECTROSCOPY**
**Benchmarks**
Proton-recoil neutron spectroscopy at the Pool Critical Assembly, 7:540 (EUR—6813(Vol.2))

**NEUTRON TRANSPORT THEORY**
**S Codes**
SAMPO: a code system giving different orders of approximation for sensitivity and perturbation analysis, 7:451

**NEUTRON-GAMMA LOGGING**
Nuclear logging methods ((part of chapter 7 - Geophysical measurements in boreholes)), 7:977

**NEUTRON-NEUTRON LOGGING**
Nuclear logging methods ((part of chapter 7 - Geophysical measurements in boreholes)), 7:977

**NEUTRON-RICH ISOTOPES**
**Beta Decay**
Decay properties of neutron-rich isotopes of Rb ($Z = 37$) to Tc ($Z = 43$) and the mass-energy surface around $A = 100$. Chapter 5, 7:1590

**NEUTRONS**
*See also FISSION NEUTRONS*
**Diagnostic Techniques**
In vivo medical applications of neutrons for diagnosis, 7:1085 (INIS-mf—6531)

**NEVADA**
**Radioactive Waste Disposal**
Low-level radioactive waste management: case studies on commercial burial sites, 7:189 (NP—2900893)
**Radioactive Waste Management**
Low-level radioactive waste management: case studies on commercial burial sites, 7:189 (NP—2900893)

**NEW MEXICO**
**Geochemical Surveys**
Jackpile-Paguate deposit: a review, 7:144
Magnitude and variability of disequilibrium in San Antonio Valley uranium deposit, Valencia County, 7:145
Organic geochemistry and uranium in Grants mineral belt, 7:103
Use of helium in uranium exploration, Grants district, 7:149
**Geologic History**
Deposition and early hydrologic evolution of Westwater Canyon wet alluvial-fan system, 7:102
**Ground Water**
Preliminary estimates of effects of uranium-mine dewatering on water levels, San Juan Basin, 7:234
**Prospecting**
Geophysical experiments at Mariano Lake uranium orebody, 7:140
**Radiometric Surveys**
Radon emanation over an orebody: search for long-distance transport of radon, 7:150
**Solution Mining**
Uranium solution mining: comparison of New Mexico with South Texas, 7:155
**Stratigraphy**
Redistributed orebodies of Poison Canyon, Sec. 18 and 19, T. 13 N., R. 9 W., McKinley County, 7:117

**Uranium Deposits**
Anomalous orebody within the Ambrosia Lake trend at Sandstone Mine, 7:142
Bernabe Montano uranium deposit, Sandoval County, 7:120
Comparison of braided-stream depositional environment and uranium deposits at Saint Anthony underground mine, 7:121
Depositional environments as ore controls in salt wash member, Morrison Formation (Upper Jurassic), Carrizo Mountains area, Arizona and New Mexico, 7:107
Depositional environment of Brushy Basin Member, Morrison Formation, in Gulf Mariano Lake mine, McKinley County, 7:111
Disconformities in Grants mineral belt and their relationship to uranium deposits, 7:139
Effects of uranium mining of ground water in Ambrosia Lake area, New Mexico, 7:233
Exploration in Grants uranium region since 1963, 7:136
Exploration for uranium deposits, Grants mineral belt, 7:137
Geochronologic studies in the Grants mineral belt, 7:138
Geology and mineral technology of the grants uranium region 1979, 7:59 (CONF-7905120—)
Geology and recognition of a relict uranium deposit in Sec. 28, T. 14 N., R. 10 W., Southwest Ambrosia Lake Area, McKinley County, 7:116
Geology and ore deposits of Johnny M mine, Ambrosia Lake District, 7:118
Geology and development of Marquez, New Mexico, uranium deposit, 7:143
Geology and characteristics of uranium mineralzation in Morrison Formation at Dennison-Bunn Claim, Sandoval County, 7:122
Geology of pre-Dakota uranium geochemical cell, sec. 13, T. 16 N., R. 17 W., Church Rock area, McKinley County, 7:108
Geology of Crownpoint Sec. 29 uranium deposit, McKinley County, 7:109
Geology of eastern Smith Lake ore trend, Grants mineral belt, 7:110
Geophysical experiments at Mariano Lake uranium orebody, 7:140
Grants and world uranium, 7:100
Heavy-mineral criteria for subsurface uranium exploration, San Juan Basin, New Mexico, 7:114
Jackpile-Paguate deposit: a review, 7:144
Magnitude and variability of disequilibrium in San Antonio Valley uranium deposit, Valencia County, 7:145
Mineralogical variations across Mariano Lake roll-type uranium deposits, McKinley County, 7:112
Mineralogy and geochemistry of Mariano Lake uranium deposit, Smith Lake district, 7:113
Organic geochemistry and uranium in Grants mineral belt, 7:103
Origin and significance of organic matter in uranium deposits of Morrison Formation, San Juan Basin, New Mexico, 7:104
Petrology of Westwater Canyon member, Morrison Formation, East Chaco Canyon drilling project, New Mexico-comparison with Grants mineral belt, 7:115
Radon emanation over an orebody: search for long-distance transport of radon, 7:150
Redistributed orebodies of Poison Canyon, Sec. 18 and 19, T. 13 N., R. 9 W., McKinley County, 7:117
Scanning-electron-microscope investigation of paragenesis of uranium deposits, Mount Taylor and elsewhere, Grants Mineral Belt, 7:119
Sedimentary controls on uranium ore at L-Bar deposits, Laguna District, New Mexico, 7:146
Stratigraphic implications of uranium deposits, 7:101
Tertiary oxidation in Westwater Canyon member of Morrison formation, 7:1262
Uranium in Todilto Limestone (Jurassic) of New Mexico: example of a Sabkha-Like Deposit, 7:147
Uranium ore rolls in Westwater Canyon sandstone, San Juan Basin, New Mexico, 7:141
Use of helium in uranium exploration, Grants district, 7:149

**Uranium Mines**
Grants and world uranium, 7:100
Preliminary estimates of effects of uranium-mine dewatering on water levels, San Juan Basin, 7:234

**Uranium Ores**
Dissolution and authigenesis of feldspars, 7:106
Uranium ore rolls in Westwater Canyon sandstone, San Juan Basin, New Mexico, 7:141

**NICKEL**

**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212

**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701

**Corrosion Resistance**
Corrosion resistance of Ni and Mo coated super alloy in He-high temperature environment, 7:682

**Crystal Defects**
Simulation of sub-threshold effects in nickel, 7:656 (KFTI—79-65)

**Ion Collisions**
$K\beta/K\alpha$ intensity ratios and energy shifts of $K\beta$ rays produced by N-ion impact, 7:1399

**Physical Radiation Effects**
Simulation of sub-threshold effects in nickel, 7:656 (KFTI—79-65)

**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)

**NICKEL ALLOYS**
*See also CHROMIUM-NICKEL STEELS*
*HASTELLOYS*
*NICKEL BASE ALLOYS*
*NICKEL-CHROMIUM STEELS*

**Phase Stability**
Effect of small fourth-element alloying additions on the calculated phase stability in the Fe-Cr-Ni system, 7:672

**Physical Radiation Effects**
Calculation of the driving force for the radiation induced precipitation of $Ni_3Si$ in nickel-silicon alloys, 7:673

**NICKEL BASE ALLOYS**
*See also HASTELLOY C*
*INCONEL ALLOYS*

**Corrosion**
Corrosion behaviour of Ni-Re, Ni-Re-Mo, Ni-Re-Hf, Ni-Re-W-Hf alloys, 7:686
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681

**NICKEL SILICIDES**

**Physical Radiation Effects**
Calculation of the driving force for the radiation induced precipitation of $Ni_3Si$ in nickel-silicon alloys, 7:673

**NICKEL-CHROMIUM STEELS**
*(Steels containing Ni and Cr; the Cr content is usually 0.5 to 2.0%, the Ni content is higher.)*

**Corrosion**
Carbon deposition on 20/25/Nb steel using an electrically heated AGR fuel pin, 7:359
Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358

**NIGER**

**Uranium Deposits**
Uranium in Niger, 7:63

**NIOBIUM**

**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701

**Heat Treatments**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)

**Oxidation**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Spectroscopy**
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)

**NIOBIUM ALLOYS**
**Electron-Phonon Coupling**
Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V, 7:1658
**Transition Temperature**
Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V, 7:1658

**NIOBIUM FLUORIDES**
**Electrolysis**
Electrochemical properties of potassium heptafluoroniobate in chloride-fluoride melts, 7:824
**Reduction**
Electrochemical properties of potassium heptafluoroniobate in chloride-fluoride melts, 7:824

**NITRATES**
**Environmental Transport**
Groundwater pollution considered as a continuous injection of tracers, 7:1035
**Water Pollution**
Solute transport in the unsaturated zone of the Chalk, 7:1034

**NITROGEN**
**Activation Analysis**
Determination of oxygen, carbon and nitrogen in calcium by the gamma activation method, 7:742 (KFTI—79-40)
Gamma activation analysis of organogenic elements in biologically active organometallic compounds, 7:743 (KFTI—79-40)
**Dissociation**
Non equilibrium dissociation rates of diatomic species. A comparison between numerical and analytical methods, 7:1470
**Electric Discharges**
Electron-beam sustained discharge in nitrogen, 7:1462
Emission properties of nitrogen laser discharges, 7:898
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
**Isotope Ratio**
Principles of isotopic analysis by mass spectrometry, 7:744 (Zfl-Mitt—32)

**NITROGEN 14**
**Mass Spectroscopy**
Principles of isotopic analysis by mass spectrometry, 7:744 (Zfl-Mitt—32)

**NITROGEN 15**
**Mass Spectroscopy**
Principles of isotopic analysis by mass spectrometry, 7:744 (Zfl-Mitt—32)

**NITROGEN IONS**
**Beam Production**
High-current DC heavy-ion source, 7:1395
**Collisions**
K$\beta$/K$\alpha$ intensity ratios and energy shifts of K$\beta$ rays produced by N-ion impact, 7:1399
**Ion-Atom Collisions**
Contribution of electron transfer to K-shell ionizations by $N^{7+}$-ion bombardment, 7:1415
**Ion-Ion Collisions**
Charge transfer in proton-hydrogenlike ion collision in a modified coulomb-born approximation, 7:1419

**NITROGEN ISOTOPES**
**Mass Spectroscopy**
New automated mass spectrometer for high precision isotope ratio determinations of gases, 7:785

**NITROGEN OXIDES**
**Air Pollution Control**
Development of a low NO/sub x/ burner for utility boilers, 7:845 (CONF-800608—(Vol.3))
**Removal**
Removal of SOx and NOx from flue gases by electron radiation, 7:984

**NOBLE GASES**
*See RARE GASES*

**NOCTILUCENT CLOUDS**
**Cations**
Positive ion composition in noctilucent clouds, 7:1374 (ESA-SP—152)

**NONAXIAL NUCLEI**
*See DEFORMED NUCLEI*

**NONDESTRUCTIVE ANALYSIS**
*See also X-RAY EMISSION ANALYSIS*
Prompt techniques. Chapter 3. Section 6, 7:753

**NONDESTRUCTIVE TESTING**
Evolution of the equipment and recent developments in the alpha, beta, gamma-laboratory of the European Institute for Transuranium Elements, 7:875

**NONMETALS**
*See also PHOSPHORUS*
*RARE GASES*
*SULFUR*
**Physical Radiation Effects**
Radiation damage in non-metals, 7:835 (AERE-TP—843)

**NON-PROLIFERATION TREATY**
Archipelago of nuclear material export licensing, 7:612 (INIS-mf—6447)

**NORTH SEA**
**Geologic History**
Mid-Cretaceous palaeontology and stratigraphy, central North Sea, 7:32
Stratigraphical relationships of Palaeocene sands in the UK sector of the central North Sea, 7:34
**Geology**
Age and nature of the crystalline basement of the North Sea Basin, 7:15
Agglutinated benthonic foraminiferal assemblages in the Palaeogene of the central North Sea: their biostratigraphic and depositional environmental significance, 7:35
**Geophysical Surveys**
Temperature, thermal gradients and heat flow in the southwestern North Sea, 7:23
**Gravity Surveys**
Regional interpretation of North Sea gravity data, 7:16
**Heat Flow**
Temperature, thermal gradients and heat flow in the southwestern North Sea, 7:23
**Paleontology**
Agglutinated benthonic foraminiferal assemblages in the Palaeogene of the central North Sea: their biostratigraphic and depositional environmental significance, 7:35
**Petroleum Geology**
Evolution of sedimentary basins in northwest Europe, 7:14
Petroleum geology of the continental shelf of northwest Europe, 7:13
**Resource Development**
Petroleum geology of the continental shelf of northwest Europe, 7:13
**Seismic Surveys**
Northern North Sea Jurassic unconformities, chronostratigraphy and sea-level changes from seismic stratigraphy, 7:30
Regional seismic structure maps of the North Sea, 7:17
Seismic stratigraphy of the North Sea Palaeocene deposits, 7:33

**NORTHERN IRELAND**
*See UNITED KINGDOM*

**NORTHERN TERRITORY**
**Copper Ores**
Mount Fitch copper and uranium deposits, Rum Jungle Uranium Field, N.T., Australia, 7:73
**Geochemical Surveys**
Geochemical investigations in the Mt. Bundey area, Northern Territory, 7:1272
**Geology**
Evolution of the Pine Creek Geosyncline, 7:1251
Fluid inclusion and oxygen isotope studies of the Nabarlek and Jabiluka uranium deposits, Northern Territory, Australia, 7:76

Geochronology and evolution of the late-Archaean basement and Proterozoic rocks in the Alligator Rivers Uranium Field, Northern Territory, Australia, 7:1252
Geologic setting of the East Alligator uranium deposits and prospects, 7:69
Geology and mineralisation of the South Alligator Valley Uranium Field, 7:70
Geology and economic significance of the Golden Dyke Dome, Northern Territory, 7:1260
Geology of the Litchfield province, N.T., 7:1259
Granite ages in the Pine Creek Geosyncline, 7:1253
Granitoids in the Pine Creek Geosyncline, 7:1254
Overview of metallic mineralization in the Pine Creek Geosyncline, 7:1257
Pine Creek Geosyncline. Statistical treatment of whole rock chemical data, 7:67
Proterozoic tectonic model for northern Australia and its economic implications, 7:1258
Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
Regional geology of the Pine Creek Geosyncline, 7:1250
Study of the Pine Creek Geosyncline using integrated Landsat and Aeromagnetic data, 7:1256

**Gravity Surveys**
Characteristics and interpretation of regional gravity, magnetic and radiometric surveys in the Pine Creek Geosyncline, 7:1264

**Hydrology**
Mining and the natural environment: water and the dispersion of pollutants, 7:230

**Magnetic Surveys**
Characteristics and interpretation of regional gravity, magnetic and radiometric surveys in the Pine Creek Geosyncline, 7:1264
Study of the Pine Creek Geosyncline using integrated Landsat and Aeromagnetic data, 7:1256

**Metamorphism**
Metamorphism in the Pine Creek Geosyncline and its bearing on stratigraphic correlations, 7:1255

**Natural Nuclear Reactors**
Natural reactor studies, 7:78

**Radiometric Surveys**
Characteristics and interpretation of regional gravity, magnetic and radiometric surveys in the Pine Creek Geosyncline, 7:1264

**Stratigraphy**
Stratigraphy of the Kapalga Formation north of Pine Creek and its relationship to base metal mineralization, 7:72

**Uranium Deposits**
Comparison of exploration techniques in Saskatchewan and the Northern Territory, 7:135
Mount Fitch copper and uranium deposits, Rum Jungle Uranium Field, N.T., Australia, 7:73

**Uranium Mines**
Uranium mining development in the Northern Territory: an overview of the issues, 7:229

**NORTHWEST TERRITORIES**

**Uranium Deposits**
Uranium geology in the Amer-Dubawnt-Yathkyed-Baker Lakes region, Keewatin District, N.W.T. Canada, 7:88

**NOZZLES**

**Fatigue**
Verification of the resistance of PWR thermal sleeves to thermal fatigue, 7:314

**Stress Analysis**
Structural analysis of a PWR vessel nozzle-to-hemisphere, 7:315

**Thermal Stresses**
Verification of the resistance of PWR thermal sleeves to thermal fatigue, 7:314

**NUCLEAR ACCIDENTS**
*See ACCIDENTS*

**NUCLEAR CHEMISTRY**

**Data Acquisition Systems**
LLNL nuclear chemistry automated production counting facilities: design and implementation, 7:1708

**NUCLEAR DATA COLLECTIONS**
Nuclear data needs and related activities of the IAEA nuclear data section, 7:1557 (ZfK—410)

**NUCLEAR ENGINEERING**

**Mathematical Models**
Application of the method of characteristics to solution of nuclear engineering problems, 7:439

**NUCLEAR FACILITIES**
*See also FUEL REPROCESSING PLANTS*
*HEAVY WATER PLANTS*

**Decommissioning**
Proceedings of the specialist meeting on decommissioning requirements in the design of nuclear facilities, Paris, March 17-19, 1980, 7:224

**Fission Product Release**
Discussion of an environmental dose methodology to obtain compliance with dose limits in the case of postulated accidents, 7:990

**Radioactive Waste Management**
United States programme for regulating radioactive airborne releases from licensed nuclear facilities, 7:564

**Remote Handling Equipment**
Experience with a servo-hydraulic mechanical testing machine installed in a new shielded active facility at Windscale Nuclear Power Development Laboratories, 7:861

**NUCLEAR FUELS**
*See also FUEL ELEMENTS*
*SPENT FUELS*

**Burnup**
Simultaneous multielement precision isotope analysis of nuclear fuel, 7:165

**Fission Product Release**
Simple treatment of fission gas for normal and accident conditions, 7:471 (IWGFPT—7)

**Isotope Ratio**
Simultaneous multielement precision isotope analysis of nuclear fuel, 7:165

**Meetings**
Summary of the symposium, 7:167

**Multi-Element Analysis**
Simultaneous multielement precision isotope analysis of nuclear fuel, 7:165

**Performance**
Computer data processing systems used in the assessment of Magnox and AGR fuel performance, 7:347

**Phase Diagrams**
Advanced fuels for fast breeder reactors. A critical assessment of some phase equilibria, 7:706

**Post-Irradiation Examination**
Postirradiation handling and examination at the HFEF complex, 7:887

**Reprocessing**
Sensitivity of light water reactor fuel cycle parameters and costs to uncertainties in thermal nuclear data and methods, 7:407

**Swelling**
Simple treatment of fission gas for normal and accident conditions, 7:471 (IWGFPT—7)

**Transport**
Liability and insurance during international transports of nuclear fuel, 7:178 (INIS-mf—6447)
System of insurance and indemnity coverage for public liability associated with nuclear materials in the course of transportation in the United States, 7:181 (INIS-mf—6447)

**NUCLEAR INDUSTRY**
Enrichment industry reaches maturity, 7:186

**Meetings**
Summary of the symposium (Thermodynamics of nuclear materials), 7:167

**Public Opinion**
Public attitudes towards the nuclear industry in Canada, 7:617

**Radiation Monitoring**
Advantages presented by the industrial introduction of information processing in the centralised surveillance of radiation levels, 7:623

**NUCLEAR INSURANCE**
Liability and insurance during international transports of nuclear fuel, 7:178 (INIS-mf—6447)

System of insurance and indemnity coverage for public liability associated with nuclear materials in the course of transportation in the United States, 7:181 (INIS-mf—6447)

**NUCLEAR MEDICINE**

*See also BIOMEDICAL RADIOGRAPHY*
*RADIOLOGY*
*RADIOTHERAPY*

**Diagnostic Techniques**

Combined application of radiology, nuclear medicine and fine needle aspiration biopsy cytology (FNAB), 7:1088

**NUCLEAR MODELS**

*See also PARTICLE-CORE MODEL*
*SHELL MODELS*

**Quarks**

Possibility of multiquark configuration existence in nuclei, 7:1615 (JINR—D-4-80-385)

**NUCLEAR POTENTIAL**

*See also FISSION BARRIER*

**Unitarity**

Unitarity constraints in the construction of 'optical potential' operators, 7:1635 (IPNO-TH—80-49)

**NUCLEAR POWER**

Energy analysis applied to uranium resource estimation, 7:62

**Environmental Impacts**

Scientific advances and community risk. Proceedings of a meeting of the Science and Industry Forum of the Australian Academy of Science, held on October 6-7, 1978, 7:235

**Hearings**

Inquiries into nuclear energy, 7:624

**Planning**

Study on the future nuclear power development strategy in Korea, 7:622

**Public Opinion**

Nuclear energy controversy in Austria. A sociological problem, 7:616
Risk and response, 7:614
Swedish nuclear referendum 1980, 7:615
Trends in public opinion. The national scene, 7:625
Trends in public opinion. . The Ontario case, 7:626

**Risk Assessment**

Risk and response, 7:614

**Social Impact**

Science and its impact on society: Indian experience. Proceedings of a seminar, 7:1051

**NUCLEAR POWER PLANTS**

**Communications**

Distributed systems design using separable communications, 7:531 (AECL—7056)

**Containment**

Applicability of JIS SPV 50 steel to primary containment vessels of nuclear power stations, 7:670

**Control Systems**

Design concepts and experience in the application of distributed computing to the control of large CEGB power plant, 7:274 (AECL—7056)

**Decontamination**

Choice of the method and reagents for maintenance washing and decontamination of the NPP equipment, 7:470

**Electromagnetic Pulses**

EMPs and nuclear power, 7:556

**Environmental Impacts**

Energy sources: Australia's needs. Proceedings of the Australian Institute of Energy first National Conference, held in Newcastle on February 5-9, 1979, 7:998

**Filters**

In situ and laboratory testing of iodine filters in Italy, 7:565

**Leak Detectors**

Leak detection system with distributed microprocessor in the primary containment vessel, 7:535 (AECL—7056)

**Legal Aspects**

Technical standardization and law. Papers and discussions, 7:430

**Meetings**

Gas chemistry in nuclear reactors and large industrial plant, 7:842

**On-Line Control Systems**

Data management problems with a distributed computer network on nuclear power stations, 7:529 (AECL—7056)
Design of a real-time software system for the distributed control of power station plant, 7:525 (AECL—7056)
Distributed architecture in the control of the PWR 1300 MW nuclear plants of electricite de France, 7:524 (AECL—7056)
Fail-safe design criteria for computer-based reactor protection systems, 7:545 (AECL—7056)
Requirements and concepts for a nuclear plant surveillance and diagnostic system (NPSDS), 7:523 (AECL—7056)

**Radioactive Effluents**

Fate of major radionuclides in the liquid wastes released to coastal waters, 7:1047
Protection of the public and environment, 7:539

**Reactor Licensing**

Standardization and the atomic energy law, 7:429

**Reactor Safety**

EMPs and nuclear power, 7:556

**Surveillance**

Requirements and concepts for a nuclear plant surveillance and diagnostic system (NPSDS), 7:523 (AECL—7056)

**NUCLEAR REACTION ANALYSIS**

*(Chemical analysis based on detection and analysis of prompt nuclear reaction products, e.g., gamma rays, neutrons, or charged particles.)*

Specific counting techniques. Chapter 3. Section 5, 7:752

**NUCLEAR REACTIONS**

*See also HADRON REACTIONS*
*PHOTONUCLEAR REACTIONS*
*PRECOMPOUND-NUCLEUS EMISSION*

**Information Needs**

Nuclear data needs and related activities of the IAEA nuclear data section, 7:1557 (ZfK—410)

**Nuclear Models**

Foundations and models of pre-equilibrium decay, 7:1610 (IAEA-SMR—43)

**NUCLEAR STRUCTURE**

**Hartree-Fock Method**

Bruckner-Hartree-Fock as a starting point for the description of excited states in nuclei, 7:1583
Selfconsistent description of nuclei, 7:1629

**Nucleon-Nucleon Interactions**

Effective interactions for nuclear structure, 7:1633

**Self-Consistent Field**

Selfconsistent description of nuclei, 7:1629

**NUCLEAR TRADE**

**Foreign Policy**

Archipelago of nuclear material export licensing, 7:612 (INIS-mf—6447)

**NUCLEAR WASTES**

*See RADIOACTIVE WASTES*

**NUCLEON-NUCLEON INTERACTIONS**

*See also PROTON-NEUTRON INTERACTIONS*
*PROTON-PROTON INTERACTIONS*

**Effective Range Theory**

Effective interactions for nuclear structure, 7:1633

**Exchange Interactions**

Joining the quark theory to the hadron exchange theory of interactions, 7:1529 (IPNO-TH—80-49)

**Nuclear Structure**

Effective interactions for nuclear structure, 7:1633

**Three-Body Problem**

Unitary pole approximation, 7:1634

**Unitary Pole Approximation**

Unitary pole approximation, 7:1634

**NUCLEONS**

*See also NEUTRONS*

**Electroproduction**

Correlation mechanism of NN pair electroproduction on nuclei, 7:1621 (KFTI—79-48)
Theory of electroproduction of small relative momentum nucleon pairs on atomic nuclei, 7:1561 (KFTI—79-48)

**Structure Functions**

QCD-tests in lepton nucleon scattering experiments, 7:1535

# O

**OBRIGHEIM REACTOR**
**Fuel Elements**
Post irradiation analysis of high burn-up light water reactor fuel elements, 7:294 (EUR—6813(Vol.2))
**OCCUPATIONAL SAFETY**
Flexibility in radiation protection legislation. The UK approach, 7:630
**Standardization**
Standardization and workers' protection legislation, 7:1050
**OFF-GAS SYSTEMS**
Released rare gas and its hold-up in nuclear power plant, 7:280 (KURRI-TR—179)
**OIL BURNERS**
**Design**
Development of a low NO/sub x/ burner for utility boilers, 7:845 (CONF-800608—(Vol.3))
**OIL FIELDS**
**Geologic Models**
Refinement of the geological model of the Thistle Field, 7:38
Reservoir geological model of the Brent Sands in southern Cormorant, 7:39
Reservoir geology of the Forties oilfield, 7:44
**Geology**
Geology of the Magnus oilfield, 7:41
Heather oil field, 7:40
Wytch Farm oil field, Dorset, 7:53
**Petroleum Geology**
Brae oilfield area, 7:42
**Reservoir Engineering**
Geological input to reservoir simulation of the Brent Formation, 7:37
**Resource Development**
Piper oilfield, 7:43
**Resource Potential**
Geology of the Magnus oilfield, 7:41
**Simulation**
Geological input to reservoir simulation of the Brent Formation, 7:37
**Stratigraphy**
Petroleum geology of the continental shelf of northwest Europe, 7:13
Piper oilfield, 7:43
Wytch Farm oil field, Dorset, 7:53
**OKG-1 REACTOR**
**Fuel-Cladding Interactions**
Operation with monosequences in ASEA-ATOM BWR. A way of reducing the impact of PCI, 7:279 (IWGFPT—8)
**OKG-2 REACTOR**
**Fuel-Cladding Interactions**
Operation with monosequences in ASEA-ATOM BWR. A way of reducing the impact of PCI, 7:279 (IWGFPT—8)
**OKLO PHENOMENON**
Alkali and alkaline earth element studies at Oklo, 7:60
Deposit of Oklo and its natural nuclear reactors, 7:91
Syngenetic model for some early Proterozoic uranium deposits. Evidence from Oklo, 7:95
**ON-LINE CONTROL SYSTEMS**
Design development and commissioning of two distributed computer based boiler control systems, 7:533 (AECL—7056)
Distributed systems for the protection of nuclear stations, 7:443 (AECL—7056)
**Design**
Fail-safe design criteria for computer-based reactor protection systems, 7:545 (AECL—7056)
**ONTARIO**
**Nuclear Power**
Trends in public opinion. . The Ontario case, 7:626
**OPTICAL MODELS**
**Nuclear Potential**
Phenomenological optical potentials and optical model computer codes, 7:1607 (IAEA-SMR—43)
Theoretical aspects of the optical model, 7:1605 (IAEA-SMR—43)
**R Matrix**
Matrix methods in the optical model. Spherical nuclei, 7:1606 (IAEA-SMR—43)
**Reviews**
Phenomenological optical potentials and optical model computer codes, 7:1607 (IAEA-SMR—43)
**Unitarity**
Unitarity constraints in the construction of 'optical potential' operators, 7:1635 (IPNO-TH—80-49)
**ORBITING SOLAR OBSERVATORIES**
Proposal for an interplanetary mission to sound the outer regions of the solar corona, 7:1365
**ORDER-DISORDER TRANSFORMATIONS**
**Statistical Models**
Percolation processes, 7:1646 (INIS-mf—6084)
**ORGANIC COMPOUNDS**
*See also ORGANIC SULFUR COMPOUNDS*
*ORGANOMETALLIC COMPOUNDS*
**Dynamic Function Studies**
Dynamic aspects of soil organic matter and its relationship to the physical properties and fertility of soils, 7:1123 (IAEA-TECDOC—236)
**ORGANIC MATTER**
**Chemical Radiation Effects**
Organic geochemistry and uranium in Grants mineral belt, 7:103
**Structural Chemical Analysis**
Organic geochemistry and uranium in Grants mineral belt, 7:103
**ORGANIC SULFUR COMPOUNDS**
**Radiosensitivity Effects**
Chemical protection and sensitization to ionizing radiation molecular investigations, 7:1198
**ORGANOMETALLIC COMPOUNDS**
**Excited States**
Photoexcited states of organic anions, 7:834
**Photochemistry**
Photoexcited states of organic anions, 7:834
**ORIENTED NUCLEI**
**Pion Reactions**
Pion-nucleus interaction and nuclear structure (experiment), 7:1616 (JINR-D—4-80-385)
**ORNL-PCA REACTOR**
**Benchmarks**
Application of DUCKPOND to the OAK RIDGE PCA calculational blind test, 7:308
**Proton Recoil Detectors**
Proton-recoil neutron spectroscopy at the Pool Critical Assembly, 7:540 (EUR—6813(Vol.2))
**OSKARSHAMN-1 REACTOR**
*See OKG-1 REACTOR*
**OSKARSHAMN-2 REACTOR**
*See OKG-2 REACTOR*
**OUTER CONTINENTAL SHELF**
*See CONTINENTAL SHELF*
**OVARIES**
**Biological Radiation Effects**
Estrogen excretion in woman working for a long period of time with ionizing radiation sources, 7:1231
**OXALATES**
**Chemical Reactions**
Precipitation of radiostrontium in soil, 7:1008
**OXIDES**
**Chemical Reaction Kinetics**
Bibliographies on radiation chemistry. 3. Formation and reactivity of the superoxide radical anion, 7:838
**Crystal Defects**
Defect modelling, 7:647 (AERE-TP—843)
**OXIDOREDUCTASES**
**Radioprotective Substances**
Catalase and superoxide dismutase levels in radiation resistant strains of D. melanogaster, 7:1162 (INIS-mf—6531)
**OXYGEN**
**Activation Analysis**
Determination of oxygen, carbon and nitrogen in calcium by the gamma activation method, 7:742 (KFTI—79-40)

Gamma activation analysis of organogenic elements in biologically active organometallic compounds, 7:743 (KFTI—79-40)
Neutron counting in activation analysis. Chapter 3. Section 3, 7:750
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
**Quantitative Chemical Analysis**
Sodium sampling and impurities determination, 7:741 (INIS-mf—6423)
**OXYGEN 16**
**Energy Levels**
Bruckner-Hartree-Fock as a starting point for the description of excited states in nuclei, 7:1583
**Temperature Measurement**
Oxygen isotope geothermometry on high-grade metamorphic rocks, 7:1275
**OXYGEN 16 REACTIONS**
**Deep Inelastic Heavy Ion Reactions**
High spin isomeric states in $^{152}$Dy, 7:1592 (INP—1014/PL)
**OXYGEN 16 TARGET**
**Electron Reactions**
Exchange internucleon interactions in deep inelastic electron scattering by nuclei, 7:1565 (KFTI—79-48)
**Photonuclear Reactions**
Study of the ($\gamma$, $\pi^0$p) reaction of $^6$Li, $^{12}$C and $^{16}$O nuclei in a wide range of transferred momentum, 7:1574 (KFTI—80-6)
**OXYGEN 18**
Investigation of the formation of atomic complexes in the spark ion source by the use of stable isotope tracers, 7:771
**Temperature Measurement**
Oxygen isotope geothermometry on high-grade metamorphic rocks, 7:1275
**OXYGEN EFFECT (RADIOBIOLOGY)**
*See OXYGEN*
**OXYGEN IONS**
**Collisions**
Electron capture and loss to, or from wake-riding states by fast ions in metals, 7:1418
Inner shell ionization in the collision system of $Z_1 << Z_2$, 7:1401
**Ion-Atom Collisions**
Recoil charge-state distributions resulting from small impact parameter collisions of F and O projectiles with Ne, 7:1406
**OXYGEN ISOTOPES**
**Mass Spectroscopy**
New automated mass spectrometer for high precision isotope ratio determinations of gases, 7:785
**OXYGEN LOGS**
*See NEUTRON-GAMMA LOGGING*

## P

**PAINTS**
*See also LUMINOUS PAINTS*
**Multi-Element Analysis**
Forensic applications. Chapter 5. Section 6, 7:760
**PALLADIUM ALLOYS**
**Physical Radiation Effects**
Dynamic surface composition changes in Ag-Pd alloys under ion bombardment at different ion energies, 7:657
**PANCREAS**
**Radionuclide Kinetics**
Nuclear concentration of $^3$H-1.25(OH)$_2$ vitamin D3 in cells of pancreatic islets, 7:1071
**PARATHION**
**Environmental Transport**
Effects of combined pesticides application on their persistence in flooded rice soils (parathion; carbofuran), 7:1004
**PARTICLE BEAMS**
**Energy Spectra**
Energy and energy spectra measuring, 7:923
**PARTICLE PRODUCTION**
Particle production from nuclear targets, 7:1513
**PARTICLE-CORE MODEL**
**Rotation**
Alternative formulation of the particle-rotor model, 7:1637 (OUP—81-09)
**PARTICLE-INDUCED X-RAY EMISSION ANALYSIS**
*See X-RAY EMISSION ANALYSIS*
**PATIENTS**
**Correlations**
Autosensibilization of organism in different pathologic states and radiotherapy of oncologic patients, 7:1220
**Immunology**
Autosensibilization of organism in different pathologic states and radiotherapy of oncologic patients, 7:1220
**PCA-ORNL REACTOR**
*See ORNL-PCA REACTOR*
**PEBBLE BED REACTORS**
**Reactor Cores**
Evaluation of seismic movements of a pebble bed reactor core as basis for shaking experiments, 7:593
**PELLETS (FUEL)**
*See FUEL PELLETS*
**PELVIS**
**Computerized Tomography**
CT guided percutaneous fine needle aspiration of intra-abdominal and pelvic masses, 7:1095
**PENNING ION SOURCES**
**Performance**
High-current DC heavy-ion source, 7:1395
Improvement of multiply charged ion production for pulsed duoplasmatron of duoPIGatron, 7:1393
Multiply charged ion beams of solids from sputter duoPIGatrons, 7:1389
**PEOPLES REPUBLIC OF CHINA**
*See CHINA*
**PERITONITIS**
**Blood Circulation**
Application of radioisotopic indication by chromium-51 in diagnosis of injuries of circulating blood volume in local peritonits, 7:1117
**PERMANGANATES**
**Environmental Transport**
Groundwater pollution considered as a continuous injection of tracers, 7:1035
**PEROVSKITE**
**Calcination**
Calcination studies on perovskite, zirconolite, barium hollandite and SYNROC-B, 7:675
**Comparative Evaluations**
Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
**Leaching**
Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
**Stability**
Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
**PEROVSKITES**
**Physical Radiation Effects**
Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation, 7:718
**PERSONNEL**
*See also MINERS*
*RADIOLOGICAL PERSONNEL*
**Radiation Protection**
Advance in radiation protection monitoring. Proceedings of an international symposium held by the IAEA in Stockholm, Sweden, June 26-30, 1978 (Lead abstract), 7:1221
**PERSONNEL MONITORING**
Personal tritium monitor, 7:383
**Meetings**
Advance in radiation protection monitoring. Proceedings of an international symposium held by the IAEA in Stockholm, Sweden, June 26-30, 1978 (Lead abstract), 7:1221

**PETROLEUM**
**Combustion Kinetics**
Development of a low NO/sub x/ burner for utility boilers, 7:845 (CONF-800608—(Vol.3))
**Prices**
California energy futures: a presentation made to the California Energy Commission, 7:628 (P—300-80-033)
**PETROLEUM DEPOSITS**
*See also OIL FIELDS*
**Exploration**
Continental margin from the Porcupine Seabight to the Armorican marginal basin, 7:51
Geology of the Barents Sea, 7:45
Geology of the Cardigan Bay-St. George's Channel Basin, 7:49
Oils and source rocks of the North Sea area, 7:25
Petroleum geology of the Bay of Biscay, 7:52
Wytch Farm oil field, Dorset, 7:53
**Reservoir Rock**
Habitat of the Rijswijk oil province, onshore, the Netherlands, 7:36
**Resource Potential**
Fastnet Basin: an integrated analysis, 7:50
**PETROLEUM GEOLOGY**
**Meetings**
Petroleum geology of the continental shelf of northwest Europe, 7:13
**PFR REACTOR**
**Fuel Assembly Dismantling**
Laser cutting equipment for dismantling irradiated PFR fuel sub-assemblies, 7:886
**Hot Cells**
Operating experience in the new irradiated fuel handling and examination cave at the Prototype Fast Reactor, Dounreay, 7:408
**Remote Handling Equipment**
Operating experience in the new irradiated fuel handling and examination cave at the Prototype Fast Reactor, Dounreay, 7:408
**Spent Fuel Elements**
Post-irradiation wrapper measurements of irradiated PFR sub-assemblies at Dounreay, 7:410
**Steam Generators**
Commissioning and subsequent development of boiler feedwater control systems on the Prototype Fast Reactor, 7:426
**PHAGES**
*See BACTERIOPHAGES*
**PHARMACEUTICALS**
*See DRUGS*
**PHARMACOTHERAPY**
*See CHEMOTHERAPY*
**PHASE CHANGE MATERIALS**
**Fusion Heat**
Thermodynamic basis for selecting heat storage materials, 7:269
**PHASE TRANSFORMATIONS**
*See also BOILING*
*ORDER-DISORDER TRANSFORMATIONS*
Coupling to a secondary order parameter near the commensurate-incommensurate transition, 7:1648 (INIS-mf—6084)
**PHENIX REACTOR**
**Post-Irradiation Examination**
Post-irradiation examination on fast reactor fuel elements in France, 7:409
**PHOSPHATE GLASS**
**Chemical Analysis**
ESCA investigation of molybdenum containing silicate and phosphate glasses, 7:200
**Chemical Composition**
ESCA investigation of molybdenum containing silicate and phosphate glasses, 7:200
**PHOSPHONIC ACID ESTERS**
**Solvent Properties**
Extraction of Th(IV) and U(VI) by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:745
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**PHOSPHORIC ACID**
**By-Products**
Potential by-product uranium production in the United States of America, 7:157
**PHOSPHORUS**
**Activation Analysis**
Gamma activation analysis of organogenic elements in biologically active organometallic compounds, 7:743 (KFTI—79-40)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**PHOTODISINTEGRATION**
*See PHOTONUCLEAR REACTIONS*
**PHOTOELECTROCHEMICAL CELLS**
**Electronegativity**
Optimization of solar conversion devices, 7:256
**Materials**
Solar Materials Science, 7:260
**Reviews**
Principles of photoelectrochemical, solar energy conversion, 7:252
**PHOTOELECTRON COUNTING**
Image photon counting system for space astronomical observations, 7:949
**PHOTON ACTIVATION ANALYSIS**
*See ACTIVATION ANALYSIS*
**PHOTON-NEUTRON INTERACTIONS**
**Cross Sections**
Pion minus photoproduction on neutrons by polarized photons in the 0.9-1.65 GeV energy range, 7:1482 (KFTI—80-6)
**PHOTON-PHOTON INTERACTIONS**
**Inclusive Interactions**
Tests of QCD in two-photon collisions, 7:1546
**PHOTONUCLEAR REACTIONS**
**Differential Cross Sections**
Field model of photonuclear reactions, 7:1622 (KFTI—79-48)
**D*Resonances**
Polarization effects in the $\gamma d \rightarrow np$ reaction and D* resonances, 7:1558 (KFTI—79-48)
**Exchange Interactions**
Meson exchange and the photodisintegration of the deuteron, 7:1567
**Giant Resonance**
Field model of photonuclear reactions, 7:1622 (KFTI—79-48)
**Knock-Out Reactions**
Study of the $(\gamma, \pi^0 p)$ reaction of $^6$Li, $^{12}$C and $^{16}$O nuclei in a wide range of transferred momentum, 7:1574 (KFTI—80-6)
**Nuclear Fragments**
Instructiveness of spectra for photodisintegration products of light nuclei, 7:1573 (KFTI—79-48)
**Nuclear Models**
Field model of photonuclear reactions, 7:1622 (KFTI—79-48)
**Particle Production**
Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV, 7:1576 (KFTI—80-6)
Pion photoproduction on bound nucleons, 7:1575 (KFTI—80-6)
Reaction mechanisms in coherent nuclear photoproduction, 7:1591 (IPNO-TH—80-49)
Study of the $(\gamma, \pi^0 p)$ reaction of $^6$Li, $^{12}$C and $^{16}$O nuclei in a wide range of transferred momentum, 7:1574 (KFTI—80-6)
**Reviews**
Complete photodisintegration of three- and four-particle nuclei, 7:1563 (KFTI—79-48)
**PHWR TYPE REACTORS**
*See also CORDOBA REACTOR*
*GENTILLY-2 REACTOR*
*RAJASTHAN-1 REACTOR*
*RAJASTHAN-2 REACTOR*

**Fuel Pellets**
Characterisation of sintered $UO_2$ pellets relevant to fuel design and performance, 7:381
**Fuel Rods**
BACO fuel rod analysis computer program, 7:384
**PHYSICAL CHEMISTRY**
**Meetings**
Origins of optical activity in nature, 7:740
**PHYSICS**
**Mathematical Operators**
Polynomial and spline approximation. Theory and applications, 7:1671
**Meetings**
A.I.P. 4th national congress, Melbourne 1980, 7:1276
**PIG ION SOURCES**
*See PENNING ION SOURCES*
**PINS (FUEL)**
*See FUEL PINS*
**PION MINUS REACTIONS**
**Coherent Production**
Coherent (1), semicoherent (2) and incoherent (3) interactions on nuclei at 40 GeV/c, 7:1491
**Incoherent Production**
Coherent (1), semicoherent (2) and incoherent (3) interactions on nuclei at 40 GeV/c, 7:1491
**Multiple Scattering**
Inclusive distributions in double scattering process in $\pi$pd interactions at 205 and 360 GeV/c, 7:1493
**PION MINUS-NEUTRON INTERACTIONS**
**Inclusive Interactions**
$\pi^-\pi^-$ scattering at high energies, 7:1498
**PION MINUS-PROTON INTERACTIONS**
**Inclusive Interactions**
Inclusive distributions in double scattering process in $\pi^-$d interactions at 205 and 360 GeV/c, 7:1493
**Pair Production**
Observation of a direct low-mass $e^+e^-$ continum in $\pi^-$p interactions at 16 GeV/c, 7:1488
**PION PLUS-PROTON INTERACTIONS**
**Elastic Scattering**
Analysis of elastic scattering in the method of the generalized matrix of reactions, 7:1481 (JINR-D—2-11707)
**PION REACTIONS**
**Charge-Exchange Reactions**
Pion-nucleus interaction and nuclear structure (experiment), 7:1616 (JINR-D—4-80-385)
**Elastic Scattering**
Effect of pion absorption on the elastic $\pi$d scattering, 7:1569 (IPNO-TH—80-49)
Pion-nucleus interaction and nuclear structure (experiment), 7:1616 (JINR-D—4-80-385)
**Inelastic Scattering**
Pion-nucleus interaction and nuclear structure (experiment), 7:1616 (JINR-D—4-80-385)
**PION-DEUTERON INTERACTIONS**
**Multiple Scattering**
Inclusive distributions in double scattering process in $\pi^-$d interactions at 205 and 360 GeV/c, 7:1493
**PION-PION INTERACTIONS**
**Elastic Scattering**
$\pi^-\pi^-$ scattering at high energies, 7:1498
**PION-PROTON INTERACTIONS**
**Inclusive Interactions**
Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**Pair Production**
Production of real photons, leptons and hadrons in hadron-hadron collisions, 7:1522
**PIONS**
*See also PIONS MINUS*
*PIONS NEUTRAL*
*PIONS PLUS*
**Electromagnetic Form Factors**
Pion form factor as a Pade type approximation in the conformally mapped variable, 7:1524
**Electroproduction**
Pion electroproduction on light nuclei, 7:1572 (KFTI—79-48)
**Particle Production**
Meson production in $K^-$p interactions at 70 GeV/C, 7:1494
Particle production in anti pp annihilation and non-annihilation, 7:1515
**Photoproduction**
Reaction mechanisms in coherent nuclear photoproduction, 7:1591 (IPNO-TH—80-49)
**Structure Functions**
Evidence for scale breaking of the pion structure function, 7:1499
**PIONS MINUS**
**Photoproduction**
Pion minus photoproduction on neutrons by polarized photons in the 0.9-1.65 GeV energy range, 7:1482 (KFTI—80-6)
Pion photoproduction on bound nucleons, 7:1575 (KFTI—80-6)
**PIONS NEUTRAL**
**Photoproduction**
Pion neutral photoproduction on nuclei at small angles at average photon energy of 300 MeV, 7:1576 (KFTI—80-6)
**PIONS PLUS**
**Particle Production**
Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**PIPE RESTRAINTS**
*See RESTRAINTS*
**PIPES**
**Crack Propagation**
Crack growth rate of PWR piping, 7:327
**Creep**
Creep tensile instability, 7:455
**Mechanical Properties**
Elastic-plastic response of PWR coolant pipes containing postulated circumferential flaws, 7:326
Experimental and elastic-plastic numerical analysis of a PWR piping elbow subjected to pressure cycling, 7:322
Experimental studies of PWR secondary piping in case of steam break, 7:328
**Mechanical Vibrations**
Vibration of three-dimensional piping subject to pump pulsation, 7:324
**Ruptures**
Experimental study of pipe reaction force and jet impingement load at the pipe break, 7:288
**PITUITARY GLAND**
**Dynamic Function Studies**
Pituitary hormone effects on $^{45}Ca$ release from fetal rat bones, 7:1072
**PIXE**
*See X-RAY EMISSION ANALYSIS*
**PLACENTA**
**Membrane Transport**
Ionized calcium concentrations in Krebs-Ringer bicarbonate buffers (KRBB) and their effect on mineral transport across intestinal mucosa and placenta, 7:1079
**PLANTS (INDUSTRIAL)**
*See INDUSTRIAL PLANTS*
**PLASMA**
*See also COLD PLASMA*
*LASER-PRODUCED PLASMA*
*SOLID-STATE PLASMA*
**Kinetic Equations**
Kinetic equation for electrons in metallic and gaseous plasma with account for exchange effect, 7:1471
**PLASMIDS**
**Response Modifying Factors**
Plasmid modification of spontaneous and radiation-induced mutability in Pseudomonas aeruginosa, 7:1158 (INIS-mf—6531)
**PLASTIC SCINTILLATION DETECTORS**
**Beta Dosimetry**
Measurement of absorbed dose-rate in skin for low-level beta-rays, 7:953
**Sensitivity**
Measurement of absorbed dose-rate in skin for low-level beta-rays, 7:953
**PLASTICITY**
Constitutive modelling in plasticity, 7:693

**Mathematical Models**
Local bounds on dissipation energy in shakedown theory, 7:1667
Mathematical programming methods in engineering plasticity, 7:1665
Nonlinear endochronic theory of cylic plastic hardening and softening, 7:1664
Order, heat, intrinsic dissipation and inelastic analysis, 7:1663
Sheakedown analysis by displacement method and equilibrium finite element, 7:1666
**Mechanics**
Plastic frames: Reduction of the kinematical inequality and optimization, 7:1669

**PLATES**
*(Thicker than SHEETS or FOILS.)*
**Thermal Shock**
Behaviour of plates subjected to steady mechanical load and rapid thermal transients on both surfaces, 7:467

**PLUTONIUM**
**Chemical Analysis**
Analysis of plutonium and its compounds. Uranium determination by fluorimetry, 7:797 (CEA-CETAMA—7)
Plutonium analysis. Iron spectrophotometric determination, 7:792 (CEA-CETAMA—7)
**Mass Spectroscopy**
Plutonium isotopic analysis by thermoionization mass spectrometry, 7:808 (CEA-CETAMA—7)
**Radioecology**
Plutonium in the environment: a review, 7:996
**Spectrophotometry**
Analysis of plutonium and its nitric solutions. Boron spectrophotometric determination, 7:799 (CEA-CETAMA—7)
**Titration**
Plutonium volumetric analysis after reduction by titanium tetrachloride, 7:800 (CEA-CETAMA—7)
**Transport**
Environmental impact of plutonium transport in the event of accidents within the European Community. Estimation of potential releases, 7:175 (INIS-mf—6447)

**PLUTONIUM 238**
**Biological Radiation Effects**
Biological effects of inhaled radionuclides. Summary of ICRP report 31, 7:1184

**PLUTONIUM 239**
**Biological Radiation Effects**
Biological effects of inhaled radionuclides. Summary of ICRP report 31, 7:1184
**Maximum Permissible Intake**
Approach to the derivation of radionuclide intake limits for members of the public, 7:1188
**Retention**
Retention and effects of $^{239}$Pu in the tree shrew (Tupaia Belangeri), 7:1182
**Tissue Distribution**
Subcellular distribution of $^{239}$Pu in the liver of rat, mouse, Syrian and Chinese hamster, 7:1183

**PLUTONIUM 242**
**Evaluated Data**
Evaluation of nuclear data for $^{242}$Pu in the region of resolved and unresolved resonances ($10^{-5}$ eV-200 keV), 7:1601 (INDC(CCP)—150/LJH)
**Fission**
Evaluation of the characteristics of secondary neutrons and gamma rays in the interaction between neutrons and the $^{242}$Pu nucleus, 7:1602 (INDC(CCP)—150/LJH)
**Neutron Spectra**
Evaluation of the characteristics of secondary neutrons and gamma rays in the interaction between neutrons and the $^{242}$Pu nucleus, 7:1602 (INDC(CCP)—150/LJH)

**PLUTONIUM 242 TARGET**
**Neutron Reactions**
Evaluation of nuclear data for $^{242}$Pu in the region of resolved and unresolved resonances ($10^{-5}$ eV-200 keV), 7:1601 (INDC(CCP)—150/LJH)
Evaluation of the characteristics of secondary neutrons and gamma rays in the interaction between neutrons and the $^{242}$Pu nucleus, 7:1602 (INDC(CCP)—150/LJH)

**PLUTONIUM ALLOYS**
**Phase Stability**
Thermodynamic instability of a solid solution of aluminium in plutonium (delta-phase) at room temperature, 7:851

**PLUTONIUM CARBIDES**
**Cold Pressing**
Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors, 7:419

**PLUTONIUM COMPOUNDS**
Analysis of plutonium and its nitric solutions. Boron spectrophotometric determination, 7:799 (CEA-CETAMA—7)
**Titration**
Plutonium volumetric analysis after reduction by titanium tetrachloride, 7:800 (CEA-CETAMA—7)

**PLUTONIUM DIOXIDE**
**Physical Properties**
Studies of physical properties of plutonium dioxide powders, 7:702 (INIS-mf—6447)
**Road Transport**
Risk assessment for the transportation of $PuO_2$, $UF_6$ and spent fuel on roads in the Federal Republic of Germany, 7:176 (INIS-mf—6447)
**Sintering**
Factors affecting the sintered density of plutonium oxide, 7:521

**PLUTONIUM FLUORIDES**
**Chemical Analysis**
Analysis of plutonium and its compounds. Uranium determination by fluorimetry, 7:797 (CEA-CETAMA—7)

**PLUTONIUM ISOTOPES**
**Alpha Spectroscopy**
Comparison of mass-spectrometry and α-counting in analysis of uranium and plutonium isotopes in environmental samples, 7:767
**Mass Spectroscopy**
Comparison of mass-spectrometry and α-counting in analysis of uranium and plutonium isotopes in environmental samples, 7:767

**PLUTONIUM NITRATES**
**Packaging**
Assessment of the containment of the UK 250 litre plutonium nitrate package, 7:855 (INIS-mf—6447)

**PLUTONIUM NITRIDES**
**Cold Pressing**
Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors, 7:419

**PLUTONIUM OXIDES**
**Chemical Analysis**
Analysis of plutonium and its compounds. Uranium determination by fluorimetry, 7:797 (CEA-CETAMA—7)

**POINT LEPREAU-1 REACTOR**
**Construction**
Design and construction progress on Gentilly 2, Cordoba, Point Lepreau, and Wolsung projects, 7:382

**POLARIZED BEAMS**
**Beam Production**
Proton source for the high-intensity Lamb-shift-type polarised ion source, 7:1394

**POLLEN**
**Paleontology**
Palynology, its biostratigraphic and environmental potential, 7:1249

**POLLUTION**
*(For nonradioactive pollution only; see also CONTAMINATION.)*
*See also AIR POLLUTION*
**Meetings**
Proceedings of the groundwater pollution conference, Perth, Western Australia, Feburary 19-23, 1979, 7:232

**POLLUTION REGULATIONS**
**Environmental Policy**
Bubble concept: an examination of two applications in the utility industry, 7:1000

**POLYMERS**
**Chemical Radiation Effects**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**Heating**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**Physical Radiation Effects**
Radiation damage in non-metals, 7:835 (AERE-TP—843)
**PONDS**
*See LAKES*
**POOL CRITICAL ASSEMBLY ORNL**
*See ORNL-PCA REACTOR*
**POROUS MATERIALS**
**Fluid Flow**
Evaluation of the ability to predict radionuclide transport in groundwater flow systems, 7:228
**Fractures**
Combined fracture/porous media model for contaminant transport of radioactive ions, 7:227
**Radionuclide Migration**
Combined fracture/porous media model for contaminant transport of radioactive ions, 7:227
**PORTUGAL**
**Uranium Deposits**
History of the evaluation and exploitation of a group of small uranium mines in Portugal, 7:125
**Uranium Mines**
History of the evaluation and exploitation of a group of small uranium mines in Portugal, 7:125
**POSITRON CHANNELING**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)
**POSITRON COLLISIONS**
**Differential Cross Sections**
Positron interactions in gases, 7:1430
**Inner-Shell Ionization**
K-shell ionization of gold by electron and positron impact near the threshold energy, 7:1402
**POSITRON COMPUTED TOMOGRAPHY**
**Image Processing**
Imaging properties of a positron tomography with 280 bgo crystals, 7:1086
New tomograph for quantitative positron emission computed tomography of the brain, 7:1118
**POSITRONIUM**
Density-functional theory of positronium bubbles in low-temperature classical fluids, 7:1434
O-positronium pick-off quenching in dense gases, 1. Theoretical, 7:1431
O-positronium pick-off quenching in dense gases, 2. Experimental results in xenon and carbon dioxide, 7:1432
Positron-induced cluster and positronium bubble in low temperature helium, 7:1437
**Lifetime**
Information on the state of electrons in liquids from positronium formation data, 7:1435
**Reaction Kinetics**
Positronium formation in aqueous micellar solutions, (1), 7:1385
Positronium formation and thermalization of positrons in dense gases, 7:1433
**POSITRONIUM CHEMISTRY**
**Reviews**
New developments in positron and positronium chemistry (50 references), 7:1386
**POSITRONS**
**Angular Correlation**
Doppler broadened annihilation radiation study in various liquid mixtures, 7:1436
**Annihilation**
New developments in positron and positronium chemistry (50 references), 7:1386
**Lifetime**
Positronium formation in aqueous micellar solutions, (1), 7:1385
**Pair Production**
Observation of a direct low-mass $e^+ e^-$ continum in $\pi^- p$ interactions at 16 GeV/c, 7:1488
**Production**
Positron production in heavy ion collisions, 7:1411
**Thermalization**
Positronium formation and thermalization of positrons in dense gases, 7:1433
**POST-IRRADIATION EXAMINATION**
**Chemical Analysis**
Post-irradiation chemical analysis of irradiated nuclear fuels, 7:509
**Destructive Testing**
Some in cell machines developed for destructive PIE, 7:885
**Eddy Current Testing**
Eddy-current testing as a tool for post-irradiation examination, 7:508
**Electron Microscopy**
Remotely operated scanning electron microscope for the examination of irradiated materials, 7:884
**Hot Labs**
Postirradiation handling and examination at the HFEF complex, 7:887
**POTABLE WATER**
*See DRINKING WATER*
**POTASSIUM**
**Crystal Models**
Unified study of static and dynamic properties of alkali metals, 7:687
**Geochemistry**
Distribution of U, Th and K through a section of the granitic crust of the Vredefort basement, 7:1274
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**POTASSIUM CHLORIDES**
**Crystal Models**
Polarisable dipole models for ionic solids and their quantum mechanical justification, 7:735
**Solvent Properties**
$SrCl_2$ solubility in complex brines, 7:814
**Sputtering**
Temperature dependence of sputtering rate of alkali halides by $Ar^+$ bombardment, 7:1427
**POTASSIUM COMPOUNDS**
**Annealing**
In situ studies of transfer annealing in doped crystals of potassium chromate and tris-dipyridylcobalt(III: perchlorate trihydrate, 7:652 (INIS-mf—6450)
**Crystal Doping**
In situ studies of transfer annealing in doped crystals of potassium chromate and tris-dipyridylcobalt(III: perchlorate trihydrate, 7:652 (INIS-mf—6450)
**POTASSIUM FLUORIDES**
**Electrolysis**
Electrochemical properties of potassium heptafluoroniobate in chloride-fluoride melts, 7:824
**Reduction**
Electrochemical properties of potassium heptafluoroniobate in chloride-fluoride melts, 7:824
**POTASSIUM IONS**
**Metastable States**
Peculiarities of electric discharges in mixtures of metal vapors and rare gases at increased pressures, 7:895
**POTASSIUM OXIDES**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**POWER DISTRIBUTION SYSTEMS**
**Optimization**
Distribution-system planning using mixed-integer programming, 7:275
**POWER REACTORS**
*See also BARSEBAECK-1 REACTOR*
*BARSEBAECK-2 REACTOR*
*BIBLIS-A REACTOR*
*CIRENE REACTOR*
*CONNECTICUT YANKEE REACTOR*

*COOPER REACTOR*
*DFR REACTOR*
*GENTILLY-2 REACTOR*
*HBWR REACTOR*
*HINKLEY POINT-B REACTOR*
*HUNTERSTON-B REACTOR*
*JATR REACTOR*
*JOYO REACTOR*
*MAGNOX TYPE REACTORS*
*MILLSTONE-3 REACTOR*
*OBRIGHEIM REACTOR*
*OKG-1 REACTOR*
*OKG-2 REACTOR*
*PFR REACTOR*
*PHENIX REACTOR*
*PROCESS HEAT REACTORS*
*RAJASTHAN-1 REACTOR*
*RAJASTHAN-2 REACTOR*
*SGHWR REACTOR*
*SNR-1 REACTOR*
*TARAPUR-1 REACTOR*
*TARAPUR-2 REACTOR*
*THREE MILE ISLAND-2 REACTOR*
*THTR-300 REACTOR*
*WAGR REACTOR*
*WWER TYPE REACTORS*

**Remote Handling Equipment**
Some improvements in handling techniques into commercial nuclear reactors, 7:871

**PRASEODYMIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746

**PRECOMPOUND-NUCLEUS EMISSION**
**Exciton Model**
Application of pre-equilibrium decay models to the calculation of neutron reaction data, 7:1611 (IAEA-SMR—43)
**Nuclear Models**
Foundations and models of pre-equilibrium decay, 7:1610 (IAEA-SMR—43)

**PREEQUILIBRIUM NUCLEAR PROCESSES**
*See PRECOMPOUND-NUCLEUS EMISSION*

**PREGNANCY**
**Diagnosis**
Importance of HCG determination for the diagnosis of extrauterine pregnancy, 7:1109 (INIS-mf—6419)

**PRESSURE TUBES**
**Elongation**
Analysis of pressure tube elongation and end shield interactions in the CANDU reactors, 7:389
**Ruptures**
Simulation of the dynamic loads and stresses due to explosive rupture of a pressure tube in a scaled down model of the CIRENE reactor structure, 7:390

**PRESSURE VESSELS**
**Corrosion**
Towards the development of mechanistically-based design rules for corrosion fatigue in ductile steels, 7:660
**Cracks**
Multicavity PCPVs for HTR and GCFR systems, 7:336 (IWGHTR—2)
**Creep**
Creep tensile instability, 7:455
**Design**
Aspects on the design of modern PCRV with respect to the HHT-vessel, 7:371
Design and fabrication to assure vessel integrity, 7:458
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.1. Design of the multi-cavity prestressed concrete reactor vessel with warm liner, 7:333 (IWGHTR—2)
**Fabrication**
Design and fabrication to assure vessel integrity, 7:458
**Failure Mode Analysis**
Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:331
**Failures**
Development and testing of a liner venting system, 7:555 (IWGHTR—2)
**Forging**
Chemical inhomogeneity of large forging ingots, 7:454
**Fracture Mechanics**
Assuring structural integrity of steel reactor pressure vessels, 7:459
**Fracture Properties**
Evidence for the relative importance of dynamic fracture toughness, 7:690
Improvement of properties in heavy section nuclear reactor steel plates, 7:669
**In-Service Inspection**
Probabilistic modelling of in-service examination of PWR type reactor pressure vessels, 7:310
**Leaks**
Development and testing of a liner venting system, 7:555 (IWGHTR—2)
**Liners**
Feasibility of a multicavity PCPV with elastic hot liner for HTR, 7:373
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.3. Experimental studies on the behaviour of concrete and liner at high temperature, 7:335 (IWGHTR—2)
**Monitoring**
Monitoring of prestressed concrete pressure vessels for nuclear reactors, 7:449 (IWGHTR—2)
Surveillance of prestressed concrete pressure vessels under commissioning and operational conditions at Hunterston 'B' Power Station, 7:370
**Nozzles**
Structural analysis of a PWR vessel nozzle-to-hemisphere, 7:315
**Performance**
HTR applications of the Austrian PCPV, 7:337 (IWGHTR—2)
**Physical Radiation Effects**
Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2))
Dosimetry experiment 'Dompac'. Neutronic simulation of the thickness of a PWR pressure vessel. Irradiation damage characterization, 7:289 (EUR—6813(Vol.1))
Importance of flux calculations and dosimetry in PWR vessel surveillance programs, 7:290 (EUR—6813(Vol.1))
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369
Pressure vessel surveillance experience in Belgian power plants, 7:291 (EUR—6813(Vol.1))
Radiation damage saturation in reactor pressure vessel steel. Data and preliminary model, 7:456
Status of radiation embrittlement trend curve data base re-evaluation, 7:292 (EUR—6813(Vol.1))
**Reliability**
Design and fabrication to assure vessel integrity, 7:458
**Seismic Effects**
Seismic response comparisons for an embedded high temperature gas-cooled reactor (HTGR) on a high seismic site, 7:592
**Specifications**
Characteristics of the PCRV of the HHT demonstration plant, 7:374
**Stress Analysis**
Experiences with testing PCRV concrete and epoxy resin models, 7:448 (IWGHTR—2)
Experimental verification of a PCPV concept with elastic hot liner and regulated wall temperature, 7:446 (IWGHTR—2)
Non-linear calculation of PCRV using dynamic relaxation. 7:447 (IWGHTR—2)
**Temperature Effects**
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.2. Three-dimensional analysis of the temperature and stress fields in a HHT vessel, including effects of the thermal creep, 7:334 (IWGHTR—2)

**Thermal Insulation**
Basic design of the Krupp heat-insulating system with hot liner for PCPVs of HTRs, 7:445 (IWGHTR—2)
**Thermal Stresses**
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.2. Three-dimensional analysis of the temperature and stress fields in a HHT vessel, including effects of the thermal creep, 7:334 (IWGHTR—2)
**Thermal Testing**
Experimental verification of a PCPV concept with elastic hot liner and regulated wall temperature, 7:446 (IWGHTR—2)
**PRESSURIZED WATER REACTORS**
*See PWR TYPE REACTORS*
**PRESSURIZERS**
**Nozzles**
Verification of the resistance of PWR thermal sleeves to thermal fatigue, 7:314
**PRESTRESSED CONCRETE**
**Cracks**
Multicavity PCPVs for HTR and GCFR systems, 7:336 (IWGHTR—2)
**Failures**
Test of a model of a thin-walled prestressed concrete secondary containment structure, 7:388
**Fracture Properties**
Behaviour of concrete containment under over-pressure conditions, 7:386
**Mechanical Properties**
EDF's (Electricite de France) in service control for GCR type reactor vessels, 7:339 (IWGHTR—2)
**Stress Analysis**
Experiences with testing PCRV concrete and epoxy resin models, 7:448 (IWGHTR—2)
Experimental verification of a PCPV concept with elastic hot liner and regulated wall temperature, 7:446 (IWGHTR—2)
Non-linear calculation of PCRV using dynamic relaxation, 7:447 (IWGHTR—2)
Parametric study on ligament stresses in multi-cavity prestressed concrete reactor vessels (PCRV's), 7:372
**Stresses**
Results of strength tests on a 1:10 model of reactor containment, 7:317
**Temperature Effects**
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.2. Three-dimensional analysis of the temperature and stress fields in a HHT vessel, including effects of the thermal creep, 7:334 (IWGHTR—2)
**Tensile Properties**
Modelling and predicting behavior of prestressed concrete secondary containment structures using BOSOR 5, 7:387
**Thermal Stresses**
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.2. Three-dimensional analysis of the temperature and stress fields in a HHT vessel, including effects of the thermal creep, 7:334 (IWGHTR—2)
**Thermal Testing**
Experimental verification of a PCPV concept with elastic hot liner and regulated wall temperature, 7:446 (IWGHTR—2)
Prestressed concrete reactor vessel for the HHT-670 MW(e) demonstration plant. Pt.3. Experimental studies on the behaviour of concrete and liner at high temperature, 7:335 (IWGHTR—2)
**PRIMARY COOLANT CIRCUITS**
**Activity Levels**
Behaviour of fission products in PWR primary coolant and defected fuel rods evaluation, 7:313
**Failure Mode Analysis**
Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:331
**Hydraulics**
Thermal hydraulic analysis of Rajasthan Nuclear Power Station primary circuits, 7:394
**Pipes**
Crack growth rate of PWR piping, 7:327
Elastic-plastic response of PWR coolant pipes containing postulated circumferential flaws, 7:326
Experimental and elastic-plastic numerical analysis of a PWR piping elbow subjected to pressure cycling, 7:322
**Pressure Gradients**
Acoustic pressure pulsations in pressurized water reactors, 7:323
**Quality Assurance**
Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:311
**Reactor Materials**
High temperature alloys for the primary circuit of a prototype nuclear process heat plant, 7:380
**Restraints**
Study and measurement of impact damping in PWR reactor coolant system seismic and accident restraints, 7:325
**Seismic Effects**
Field vibration test results and design for reactor coolant piping systems of ATR 'Fugen', 7:597
Vibrational characteristics of primary reactor coolant system, 7:591
**PROBABILITY**
**Calculation Methods**
Protein constraints induced by multiframe encoding, 7:1069
**PROCESS HEAT REACTORS**
**Reactor Materials**
3-D inelastic analysis of HTR graphite structures and a comparison with A 2-D approach, 7:432
**PROLIFERATION**
**Government Policies**
International nuclear trade and non-proliferation issues. Some Canadian views, 7:621
Non-proliferation. A political problem, 7:620
**Safeguards**
Taking stock after INFCE, 7:619
**PROMETHIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**PROMINENCES (SOLAR)**
*See SOLAR PROMINENCES*
**PROPANE**
**Cracking**
Effect of surface pretreatment on the growth of carbon onto stainless steel from the decomposition of propane, 7:825
**Ion-Molecule Collisions**
Charge fractions and charge-changing cross sections of fast He ions passing through gaseous, liquid and solid media, 7:1416
**PROSTATE**
**Neoplasms**
Steroid receptors, metabolism and prostatic cancer. Workshop of the Society of Urologic Oncology and Endocrinology, Amsterdam, Netherlands, April 27-28, 1979, 7:1099
**PROTON CHANNELING**
Problems of charged particle channeling in monocrystals, 7:1649 (INIS-mf—6449)
**PROTON REACTIONS**
Proton-nucleus interactions at intermediate energies accompanied by fast proton backwards emission, 7:1570 (ITEF—129(1979))
**Capture**
Combined analysis of the angular correlations in the (p,γ) and (p,p'γ) reactions, 7:1584 (KFTI—79-40)
**Inelastic Scattering**
Combined analysis of the angular correlations in the (p,γ) and (p,p'γ) reactions, 7:1584 (KFTI—79-40)
Problem of monopole resonance in nuclei, 7:1623 (KFTI—79-48)
Proton inelastic scattering by sup(72,74)Ge nuclei, 7:1587 (KFTI—79-40)
**Knock-Out Reactions**
Nucleon association effects in reactions at medium energies, 7:1589 (JINR—D-4-80-385)

**Quasi-Free Reactions**
Nucleon association effects in reactions at medium energies, 7:1589 (JINR—D-4-80-385)
**PROTON-ANTIPROTON INTERACTIONS**
**Bound State**
Atomic bound states of the proton anti proton system, 7:1505 (TRI—79-1)
**Inclusive Interactions**
Particle production in anti pp annihilation and non-annihilation, 7:1515
**Inelastic Scattering**
Production in anti p - d interactions below 1 GeV/c, 7:1486 (TRI—79-1)
**PROTON-NEUTRON INTERACTIONS**
**Nucleon-Nucleon Potential**
Paris potential and recent observables, 7:1528 (IPNO-TH—80-49)
**PROTON-PROTON INTERACTIONS**
**Angular Distribution**
Angular flow of charge and energy in hadron hadron collisions, 7:1511
**Elastic Scattering**
Analysis of elastic scattering in the method of the generalized matrix of reactions, 7:1481 (JINR-D—2-11707)
**Inclusive Interactions**
Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**Nucleon-Nucleon Potential**
Paris potential and recent observables, 7:1528 (IPNO-TH—80-49)
**PROTOTYPE FAST REACTOR (DOUNREAY)**
*See PFR REACTOR*
**PROTOZOA**
*See also TETRAHYMENA*
**Population Dynamics**
Colonization of artificial substrates by protozoa: replicated samples, 7:1114
**PSEUDOMONAS**
**Mutations**
Plasmid modification of spontaneous and radiation-induced mutability in Pseudomonas aeruginosa, 7:1158 (INIS-mf—6531)
**Radiosensitivity**
Effect of bacteriophage C5 on ultraviolet survival in Pseudomonas aeruginosa, 7:1156 (INIS-mf—6531)
R-plasmid mediated repair in Pseudomonas aeruginosa, 7:1155 (INIS-mf—6531)
**PSI RESONANCES**
**Particle Production**
Production of D- and PSI-mesons in hadron interactions, 7:1520
**PSI-3105 RESONANCES**
**Electromagnetic Particle Decay**
Observation of the radiative transition PSI → γE(1420), 7:1489
**PSYCHOSES**
*See MENTAL DISORDERS*
**PUREX PROCESS**
**Off-Gas Systems**
Iodine removal in the Purex reprocessing process, 7:220
**PVC**
*(Polyvinyl chloride.)*
**Physical Radiation Effects**
Gamma-rays and ethylene oxide sterilization. Abstract 226, 7:1178
**PWR TYPE REACTORS**
*See also BIBLIS-A REACTOR*
*CONNECTICUT YANKEE REACTOR*
*MILLSTONE-3 REACTOR*
*OBRIGHEIM REACTOR*
*THREE MILE ISLAND-2 REACTOR*
*WWER TYPE REACTORS*
**Containment Buildings**
Analysis and design of containment liner/anchorage system, 7:330
Comparison of response spectra for aircraft impact calculated by a beam-mode and a 3D-shell-model, 7:586
Integrated structural design of nuclear power plants for high seismic areas, 7:587
Soil structure interaction analysis by different methods, 7:589
**Containment Shells**
Elasto-plastic analysis of nozzle intersections in reactor containments, 7:319
Experimental study of a spherical PWR-containment with geometrical imperfections at the welds, 7:318
Results of strength tests on a 1:10 model of reactor containment, 7:317
**Containment Systems**
Design and construction of the prestressed concrete containments of the French standard 900 MWe PWR, 7:316
**ECCS**
Model of countercurrent steam-water flow in large horizontal pipes, 7:557
**Fuel Cans**
Plastic instability of Zircaloy cladding submitted to LOCA conditions, 7:585
**Fuel Cycle**
Recycling of actinides in light water reactors, 7:431
**Fuel Element Failure**
Behaviour of fission products in PWR primary coolant and defected fuel rods evaluation, 7:313
Experimental investigation of release mechanisms responsible for airborne contamination seen during post-transport underwater unloading of a failed PWR spent fuel assembly, 7:297 (INIS-mf—6447)
**Fuel Rods**
Behavior of defective pressurized water reactor fuel rods during power ramp and power-cooling-mismatch conditions, 7:560
CONTACT 1 and 2 experiments: behavior of PWR fuel rod up to 15000 MWd.tu$^{-1}$, 7:302 (IWGFPT—7)
Effects of fission gas release on PWR fuel rod design and performance, 7:299 (IWGFPT—7)
Prediction of the optimum filling pressure for PWR fuel rods, 7:300 (IWGFPT—7)
Predictions of the thermomechanical code RESTA compared with fuel element examinations after irradiation in the BR3 reactor, 7:301 (IWGFPT—7)
**Fuel-Cladding Interactions**
Analytical interpretation of PCI related experiments, 7:306 (IWGFPT—8)
Pellet cladding interaction. Mechanical and chemical approach to modelling, 7:305 (IWGFPT—8)
Pressurized water reactor fuel duty during core operation, 7:304 (IWGFPT—8)
Theorical study and modelling of fuel cladding interaction and stress corrosion concerning the light water reactor fuel elements, 7:298 (IWGFPT—7)
**In Core Instruments**
Neutron emission observed from spent thermal reactor fuel assemblies, 7:293 (EUR—6813(Vol.2))
**Loss of Coolant**
Analysis of the RS16B experiment on fluid-structure interactions during PWR blowdown, 7:581
Calculations on the HDR core barrel response during snapback tests, 7:584
Coupled fluid-structure analysis of the core barrel behaviour during blowdown, 7:583
Fluid-structure interactions in PWR vessels during blowdown. Code development at Karlsruhe and results, 7:579
MEL finite element analysis of water-shell interactions in the context of a PWR-LOCA, 7:580
Model of countercurrent steam-water flow in large horizontal pipes, 7:557
**Meltdown**
Interaction of molten 'corium' with concrete in a hypothetical LWR core-melt-down accident. Oxidation of core materials and hydrogen production, 7:562
**Neutron Flux**
Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2))
**On-Line Control Systems**
Distributed architecture in the control of the PWR 1300 MW nuclear plants of electricite de France, 7:524 (AECL—7056)

**Pipes**
Experimental study of pipe reaction force and jet impingement load at the pipe break, 7:288
Vibration of three-dimensional piping subject to pump pulsation, 7:324
**Pressure Vessels**
Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2))
Dosimetry experiment 'Dompac'. Neutronic simulation of the thickness of a PWR pressure vessel. Irradiation damage characterization, 7:289 (EUR—6813(Vol.1))
Importance of flux calculations and dosimetry in PWR vessel surveillance programs, 7:290 (EUR—6813(Vol.1))
Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:331
Pressure vessel surveillance experience in Belgian power plants, 7:291 (EUR—6813(Vol.1))
Probabilistic modelling of in-service examination of PWR type reactor pressure vessels, 7:310
Status of radiation embrittlement trend curve data base re-evaluation, 7:292 (EUR—6813(Vol.1))
Structural analysis of a PWR vessel nozzle-to-hemisphere, 7:315
**Pressurizers**
Verification of the resistance of PWR thermal sleeves to thermal fatigue, 7:314
**Primary Coolant Circuits**
Acoustic pressure pulsations in pressurized water reactors, 7:323
Behaviour of fission products in PWR primary coolant and defected fuel rods evaluation, 7:313
Elastic-plastic response of PWR coolant pipes containing postulated circumferential flaws, 7:326
Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:331
Methods to determine the influence of quality assurance on the reliability of primary components of a PWR, 7:311
Study and measurement of impact damping in PWR reactor coolant system seismic and accident restraints, 7:325
Vibrational characteristics of primary reactor coolant system, 7:591
**Radiation Streaming**
Review of ANS special session on radiation streaming in power reactors, 7:296 (EUR—6813(Vol.2))
**Reactor Components**
Nonlinear, dynamic, plastic component-support analysis, 7:329
Seismic response analysis of nuclear power plant auxiliary mechanical equipment, 7:590
Some aspects of the interaction between systems- and structural reliability, 7:578
Vibration studies on a three-loop PWR internals model, 7:321
**Reactor Control Systems**
Nuclear reactor surveillance - neutron noise measurements and vibration analysis on French PWR internal structures, 7:538
Westinghouse designed distributed mircroprocessor based protection and control system., 7:528 (AECL—7056)
**Reactor Cores**
Dynamic behavior of a PWR-core barrel. Analytical integration of the cylindrical shell equations, 7:582
Vibration of PWR internals considering their edge conditions and holes, 7:320
**Reactor Internals**
Nuclear reactor surveillance - neutron noise measurements and vibration analysis on French PWR internal structures, 7:538
**Reactor Materials**
Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2))
**Reactor Noise**
Nuclear reactor surveillance - neutron noise measurements and vibration analysis on French PWR internal structures, 7:538
**Reactor Vessels**
Optimized reactor vessel utilizing large forged pieces, 7:309
**Secondary Coolant Circuits**
Experimental studies of PWR secondary piping in case of steam break, 7:328
**Seismic Effects**
Comparison of soil-structure interaction by different ground models, 7:588
**Shielding**
Review of ANS special session on radiation streaming in power reactors, 7:296 (EUR—6813(Vol.2))
**Spent Fuel Elements**
Experimental investigation of release mechanisms responsible for airborne contamination seen during post-transport underwater unloading of a failed PWR spent fuel assembly, 7:297 (INIS-mf—6447)
Review and comments about gamma scanning analysis on PWR and FBR fuel elements, 7:511
**Transient Overpower Accidents**
Fission gas release during anticipated PWR transients, 7:553 (IWGFPT—7)

## Q

**QUALITY ASSURANCE**
**Standardization**
Technical standards and quality assurance, 7:1714
**QUANTITATIVE CHEMICAL ANALYSIS**
Application of multiple technique surface analysis to the study of preferential sputtering and other surface phenomena, 7:1428
**QUANTUM CHROMODYNAMICS**
**Bag Model**
Colour singlets in perturbative QCD, 7:1545
**Deep Inelastic Scattering**
Energy flow and energy-energy pattern in deep inelastic scattering, 7:1539
**Electron-Positron Interactions**
Constraint of color separation on perturbative QCD, 7:1540
Jet production in $e^+e^-$ collisions to order $\alpha^3$ and $\alpha^4$ and including QCD, 7:1523
**Hadron-Hadron Interactions**
Theory of QCD plasma and hadronic collisions, 7:1541
**Hadrons**
Jet properties and the parton interpretation of the leading log scheme, 7:1554
**Lepton-Hadron Interactions**
Gluon jet effects in deep inelastic lepton-hadron collisions, 7:1537
**Lepton-Nucleon Interactions**
QCD-tests in lepton nucleon scattering experiments, 7:1535
**Perturbation Theory**
Colour singlets in perturbative QCD, 7:1545
Energy flow and energy-energy pattern in deep inelastic scattering, 7:1539
**Photon-Photon Interactions**
Tests of QCD in two-photon collisions, 7:1546
**Scale Invariance**
High order contributions to scaling violations in QCD, 7:1536
**Vertex Functions**
QCD tests: 3G vertex effects, 7:1547
**QUANTUM MECHANICS**
**Meetings**
Molecular physics and quantum chemistry: into the 80's, 7:1397
**QUARK CONFINEMENT**
*See BAG MODEL.*
**QUARK MODEL**
**Kaon-Proton Interactions**
Inclusive $\pi i/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**Particle Production**
Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**Pion-Proton Interactions**
Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512
**Proton-Proton Interactions**
Inclusive $\pi^+/\pi^-$ ratio in meson-proton reactions and the quark recombination model, 7:1512

**QUARK-ANTIQUARK INTERACTIONS**
Potential models of new particles, 7:1543
**QUARKONIUM**
**Bound State**
Bound states of heavy quarks, 7:1551 (IPNO-TH—80-49)
**QUARKS**
**Diagrams**
Leptons, quarks and hadrons in a same theoretical approach, 7:1527 (IPNO-TH—80-49)
**Jet Model**
Structure of multiparticles in quark jets, 7:1510
**Structure Functions**
Quarks and hadrons: structure functions and fragmentation functions, 7:1534
**QUARTZ**
**Physical Radiation Effects**
Metamictization by heavy ion bombardment of α-quartz, zircon, monazite and nitride structures (3 MeV ion beams), 7:719
**Sorptive Properties**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**QUEENSLAND**
**Uranium Deposits**
Association of uranium and skarn development in the Mary Kathleen area, Queensland, 7:94

## R

**RABBITS**
**Auditory Organs**
In vivo study of effects of ionizing radiation in rabbit ear chambers, 7:1160 (INIS-mf—6531)
**Radiation Injuries**
Morphology and ultrastructure of radiation induced tissue damage in rabbit ear chambers, 7:1161 (INIS-mf—6531)
**RADIATION ACCIDENTS**
**Delayed Radiation Effects**
Radiological consequences of the Three Mile Island accident, 7:1187
**Therapy**
Four observations of surgical treatment of wounds contaminated by radionuclides, 7:1186
**RADIATION DECONTAMINATION**
*See DECONTAMINATION*
**RADIATION DETECTORS**
*See also BEAM MONITORS*
*DIELECTRIC TRACK DETECTORS*
*GEIGER-MUELLER COUNTERS*
*IONIZATION CHAMBERS*
*NEUTRON DETECTORS*
*RADIATION MONITORS*
*SCINTILLATION COUNTERS*
*SPECTROMETERS*
**Accuracy**
Si reactor damage monitors and their application, 7:444 (EUR—6813(Vol.1))
**RADIATION DOSEMETERS**
*See DOSEMETERS*
**RADIATION DOSES**
**Biological Indicators**
Study of chromosome aberration yield in human lymphocytes as an indicator of radiation dose, 7:1170 (INIS-mf—6531)
**RADIATION EXPOSURE (DOSES)**
*See RADIATION DOSES*
**RADIATION MONITORING**
*See also PERSONNEL MONITORING*
**On-Line Systems**
Advantages presented by the industrial introduction of information processing in the centralised surveillance of radiation levels, 7:623
**RADIATION MONITORS**
Study of devices for the non destructive examination of drums containing low activity waste by neutron transport and gamma radiation codes, 7:236 (EUR—6629)
**Accuracy**
Tritium - is it underestimated, 7:961
**Alarm Systems**
Microprocessor based area monitor system for neutron and gamma radiation, 7:921
Use of informatic for radiation control panels, 7:951
**Ionization Chambers**
Personal tritium monitor, 7:383
**Microprocessors**
Microprocessor based area monitor system for neutron and gamma radiation, 7:921
Use of informatic for radiation control panels, 7:951
**Sensitivity**
Considerations on the detection limit in measurements of low level radioactive samples, 7:933 (IAEA-TECDOC—229)
**RADIATION PROTECTION LAWS**
Occupational radiation protection legislation in Israel, 7:632
Protection and security of transport of special nuclear materials (including measures for the transportation by rail:, 7:180 (INIS-mf—6447)
Review from the regulatory position of the control of occupational exposure associated with the first 20 years of the United Kingdom commercial nuclear power programme, 7:631
**RADIATION SYNDROME**
**Mucoproteins**
Fractional composition of sulfurmucoids in rats at acute radiation sickness, 7:1206
Study on fractional composition of serous and tissue mucoproteins in rats in norm and at acute radiation sickness, 7:1208
**Response Modifying Factors**
Changes in morphological and cytochemical indices of peripheral blood in white rats following combined effect of permanent magnetic field and ionizing radiation, 7:1228
**RADIOACTIVE BIOLOGICAL WASTES**
*See RADIOACTIVE WASTES*
**RADIOACTIVE EFFLUENTS**
*See also RADIOACTIVE WASTES*
**Radiation Monitoring**
Protection of the public and environment, 7:539
**Radioecological Concentration**
Fate of major radionuclides in the liquid wastes released to coastal waters, 7:1047
**RADIOACTIVE MATERIALS**
*See also FISSION PRODUCTS*
*RADIOACTIVE WASTES*
**Dose Limits**
Implications of the new limits for intake (ICRP 26 and ICRP 30: on the $A_1$ and $A_2$ values, 7:179 (INIS-mf—6447)
**Nuclear Trade**
Archipelago of nuclear material export licensing, 7:612 (INIS-mf—6447)
**Packaging**
Importance of leak flow mode assumptions for interpretation of package leaktightness tests and influence of test conditions on conclusions, 7:853 (INIS-mf—6447)
Leak testing and activity leakage rate evaluation. Practical experiences, first approaches to some systemization and outstanding problems, 7:854 (INIS-mf—6447)
Radioactive materials packages and the British railway accident environment, 7:177 (INIS-mf—6447)
**Packaging Rules**
Implications of the new limits for intake (ICRP 26 and ICRP 30: on the $A_1$ and $A_2$ values, 7:179 (INIS-mf—6447)
**Rail Transport**
Protection and security of transport of special nuclear materials (including measures for the transportation by rail:, 7:180 (INIS-mf—6447)
Radioactive materials packages and the British railway accident environment, 7:177 (INIS-mf—6447)
**Road Transport**
Safety analysis on transportation of radioactive materials by truck in Japan, 7:174 (INIS-mf—6447)
**Storage**
Investigation of gas leakage from sealing constructions at containments for radioactive materials, 7:860 (INIS-mf—6447)

**Transport**
Comparison of potentional crush and impact environments, 7:856 (INIS-mf—6447)
Evaluating dangerous goods emergency response with time/loss analyses, 7:858 (INIS-mf—6447)
It's a mad mad world, 7:182 (INIS-mf—6447)
Need for emergency preparedness in transport of radioactive materials, 7:857 (INIS-mf—6447)

**RADIOACTIVE WASTE DISPOSAL**
**Economic Analysis**
Low-level radioactive waste management: an economic assessment, 7:185 (NP—2900892)
**Engineered Safety Systems**
Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
Highly compacted bentonite: a self-healing substance for nuclear waste isolation, 7:219
Scientific basis for nuclear waste management. Volume 3, 7:188
Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
Technical barriers against a contact of groundwater with disposed radioactive waste, 7:218
**Evaluation**
Geoscientific evaluation of radioactive waste isolation in Japan, 7:198
**Geologic Deposits**
Alkali and alkaline earth element studies at Oklo, 7:60
Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
Basalt waste isolation project data package for reference physicochemical conditions, 7:193
**High-Level Radioactive Wastes**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state, 7:226 (NP—2900750)
**Low-Level Radioactive Wastes**
Low-level radioactive waste management: an economic assessment, 7:185 (NP—2900892)
Low-level radioactive waste management: case studies on commercial burial sites, 7:189 (NP—2900893)
**Marine Disposal**
Environmental monitoring and deep ocean disposal of packaged radioactive waste, 7:222
Fate of major radionuclides in the liquid wastes released to coastal waters, 7:1047
**Meetings**
Proceedings of the workshop on borehole and shaft plugging, Columbus, 7-9 May 1980, 7:190
**Radionuclide Migration**
Combined fracture/porous media model for contaminant transport of radioactive ions, 7:227
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
Migration of radionuclides following shallow land burial, 7:231
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**Risk Assessment**
Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
Evaluation of product specifications with a safety analysis for a disposal mine, 7:194
Laboratory investigation of water content within rock salt and its behavior in a temperature field of disposed high-level waste, 7:196
Thermal conductivity of selected repository minerals, 7:197
**Salt Deposits**
Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
Evaluation of product specifications with a safety analysis for a disposal mine, 7:194
Technical barriers against a contact of groundwater with disposed radioactive waste, 7:218
**Spent Fuels**
Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
**Underground Disposal**
Low-level radioactive waste management: case studies on commercial burial sites, 7:189 (NP—2900893)

**RADIOACTIVE WASTE FACILITIES**
**Design**
Technical barriers against a contact of groundwater with disposed radioactive waste, 7:218
**Safety**
Evaluation of product specifications with a safety analysis for a disposal mine, 7:194
**Specifications**
Basalt waste isolation project data package for reference physicochemical conditions, 7:193

**RADIOACTIVE WASTE MANAGEMENT**
*See also RADIOACTIVE WASTE STORAGE*
**High-Level Radioactive Wastes**
High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state, 7:226 (NP—2900750)
Recommendations on national radioactive waste management policies: report to the President, 7:241 (NP—2900894)
Scientific basis for nuclear waste management. Volume 3, 7:188
**Low-Level Radioactive Wastes**
Low-level radioactive waste management: charting state issues and responsibilities, 7:613 (NP—2900890)
Low-level radioactive waste management: a regional compact, 7:242 (NP—2900891)
Low-level radioactive waste management: an economic assessment, 7:185 (NP—2900892)
Recommendations on national radioactive waste management policies: report to the President, 7:241 (NP—2900894)
**Meetings**
Scientific basis for nuclear waste management. Volume 3, 7:188
**Recommendations**
Low-level radioactive waste management: charting state issues and responsibilities, 7:613 (NP—2900890)
Recommendations on national radioactive waste management policies: report to the President, 7:241 (NP—2900894)
**Regulations**
United States programme for regulating radioactive airborne releases from licensed nuclear facilities, 7:564
**Research Programs**
Management of sodium-bearing transuranic waste and scrap materials, 7:192
**Spent Fuels**
Recommendations on national radioactive waste management policies: report to the President, 7:241 (NP—2900894)

**RADIOACTIVE WASTE PROCESSING**
*See also IODOX PROCESS*
**Cesium**
Stability of pollucite in hydrothermal fluids, 7:705
**Compacting**
Melting process to condition decladding hulls generated by the reprocessing of LWR and FBR spent fuels, 7:211
**Encapsulation**
Diffusion of cesium in concrete, 7:210
Matrix-encapsulated waste forms: application to idealized systems, commercial and SRP/INEL wastes, hydrated radiophases and encapsulant phases, 7:206
**High-Level Radioactive Wastes**
Matrix-encapsulated waste forms: application to idealized systems, commercial and SRP/INEL wastes, hydrated radiophases and encapsulant phases, 7:206
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
Recent progress on SYNROC development, 7:205
**Hot Pressing**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209
Treatment of cladding hulls by the HIPOW process, 7:207
**Intermediate-Level Radioactive Wastes**
Leach and corrosion tests under normal and accident conditions on cement products from simulated intermediate level evaporator concentrates, 7:213

**Ion Exchange**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209
**Low-Level Radioactive Wastes**
Bituminization of low-level liquid waste, 7:208
**Melting**
Melting process to condition decladding hulls generated by the reprocessing of LWR and FBR spent fuels, 7:211
**Solidification**
Bituminization of low-level liquid waste, 7:208
ESCA investigation of molybdenum containing silicate and phosphate glasses, 7:200
Leach and corrosion tests under normal and accident conditions on cement products from simulated intermediate level evaporator concentrates, 7:213
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
Recent progress on SYNROC development, 7:205
Stable product low leach glasses, 7:202
Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses, 7:201
Tailored ceramic nuclear waste forms: preparation and characterization, 7:204
**Transmutation**
Design of fuel pins containing by-product actinides for irradiation in LWR and FBR power plants, 7:187 (EUR—6929)
**Tritium**
Treatment of cladding hulls by the HIPOW process, 7:207

**RADIOACTIVE WASTE STORAGE**
**Engineered Safety Systems**
Diffusion of cesium in concrete, 7:210
**High-Level Radioactive Wastes**
High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state, 7:226 (NP—2900750)
Predicting the reaction state of brines in proposed regions of nuclear waste isolation (Computer model AQ/SALT), 7:195
**Radionuclide Migration**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**Salt Deposits**
Predicting the reaction state of brines in proposed regions of nuclear waste isolation (Computer model AQ/SALT), 7:195
**Underground Storage**
Parametric study of the temperature differential across the wall of an underground storage vault for monitored storage of radioactive wastes, 7:225

**RADIOACTIVE WASTES**
*See also ALPHA-BEARING WASTES*
*CALCINED WASTES*
*HIGH-LEVEL RADIOACTIVE WASTES*
*LOW-LEVEL RADIOACTIVE WASTES*
*RADIOACTIVE EFFLUENTS*
**Land Transport**
Motor carrier routing using the COMPU.MAP program, 7:172 (INIS-mf—6447)
**Transport**
Drum system CEFE - a new double door transfer system, 7:183

**RADIOACTIVITY LOGGING**
*See also GAMMA LOGGING*
*GAMMA-GAMMA LOGGING*
*NEUTRON-GAMMA LOGGING*
*NEUTRON-NEUTRON LOGGING*
Radiometric and nuclear geophysics methods, 7:976

**RADIOBIOLOGY**
**Research Programs**
Research activities of the Medical Research Council's Radiobiology Unit at Harwell, Great Britain, 7:1143 (INIS-mf—6531)

**RADIOCARBON DATING**
*See CARBON 14*
*ISOTOPE DATING*

**RADIODIAGNOSIS (RADIONUCLIDES)**
*See NUCLEAR MEDICINE*

**RADIOGRAPHY (BIOMEDICAL)**
*See BIOMEDICAL RADIOGRAPHY*

**RADIOIMMUNOASSAY**
**Data Processing**
Prerequisites and possibilities of small computer processing of RIA results, 7:1053 (INIS-mf—6419)
**Performance Testing**
Factors affecting qualitative and quantitative $T_4$ determination by RIA. (Experimental $T_4$ RIA kits), 7:1060 (INIS-mf—6419)

**RADIOISOTOPE KINETICS**
*See RADIONUCLIDE KINETICS*

**RADIOISOTOPE MIGRATION**
*See RADIONUCLIDE MIGRATION*

**RADIOISOTOPES**
*See also MILLISEC LIVING RADIOISOTOPES*
*NEUTRON-RICH ISOTOPES*
*SECONDS LIVING RADIOISOTOPES*
**Electrophoresis**
Separation of elements by the electromigration method, 7:790

**RADIOLOGICAL PERSONNEL**
**Pregnancy**
Child-bearing function in women with ionizing radiation, 7:1213
**Radiation Doses**
Radiation hygiene working conditions and health state of the personnel dealing with sealed radioactive materials (Sealed sources: $^{60}Co$, $^{226}Ra$, Po-Be sources), 7:1234

**RADIOLOGY**
*See also BIOMEDICAL RADIOGRAPHY*
*RADIOTHERAPY*
**Diagnostic Techniques**
Combined application of radiology, nuclear medicine and fine needle aspiration biopsy cytology (FNAB), 7:1088

**RADIOMETRIC ANALYSIS**
**Automation**
Automated nuclear geophysical instruments, 7:769

**RADIOMETRIC GAGES**
**Level Indicators**
Continuous level gauge for horizontal cylindrical vessels, 7:932 (IA—1356)
Portable nuclear level gauge using a neutron source, 7:931 (IA—1356)
**Performance Testing**
Radiometric gage for ash content monitoring in solid fuels, 7:973 (INIS-mf—6422)

**RADIOMETRIC SURVEYS**
Radiometric and nuclear geophysics methods, 7:976

**RADIONUCLIDE KINETICS**
*(In living organisms.)*
**Comparative Evaluations**
Retention and effects of $^{239}Pu$ in the tree shrew (Tupaia Belangeri), 7:1182
**Tracer Techniques**
Imaging properties of a positron tomography with 280 bgo crystals, 7:1086

**RADIONUCLIDE MIGRATION**
*(In environment.)*
**Forecasting**
Evaluation of the ability to predict radionuclide transport in groundwater flow systems, 7:228
**Remote Sensing**
Remote sensing of soil radionuclide fluxes in a tropical ecosystem, 7:1007

**RADIONUCLIDES**
*See RADIOISOTOPES*

**RADIOPROTECTIVE SUBSTANCES**
*See also MEA*
**Radiation Chemistry**
Chemical protection and sensitization to ionizing radiation molecular investigations, 7:1198

**RADIOSENSITIZERS**
**Radiation Chemistry**
Chemical protection and sensitization to ionizing radiation molecular investigations, 7:1198

**RADIOSTERILIZATION**
**Meetings**
Seventh world congress of anaesthesiologists, 7:1203

**RADIOSURGERY**
*See RADIOTHERAPY*

**RADIOTHERAPY**
Clinical and economic aspects of radiotherapy of nontumoral diseases, 7:1102
**Biological Radiation Effects**
Dynamics of hematologic indices in patients with breast cancer in megavolt gamma therapy, 7:1235
**Side Effects**
Analysis of chromosomal aberrations of leukocytes of peripheric blood in patients with depression of different genesis hematopoiesis, 7:1219
Functional state of adrenal glands of patients with endometrium cancer before and after radiotherapy, 7:1217
Hemodynamic changes in patients with cervix uteri carcinoma in the process of combined radiotherapy according to the data of arterial oscillography, 7:1218
Immediate and delayed radiation reaction of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1216
State of motor function of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1240
**Uses**
Experiment on radiotherapy of postnatal mastitis, 7:1237
**RADIUM**
**Scintillation Counting**
Water analysis. Radium determination by scintillation, 7:803 (CEA-CETAMA—7)
**RADIUM 226**
**Radiation Monitoring**
$^{226}$Ra- and $^{222}$Rn-content of drinking water, 7:1049
**RBE**
RBE of $\alpha$-particles versus $\beta$-particles in bone sarcoma induction, 7:1185
**Synergism**
Neoplasm appearance resulting from chronic intake of mixtures of radium-226, strontium 90, ddt, 7:1233
**RADON**
**Inhalation**
Inhalation of radon and its daughter products. Doses and pathological effects, 7:1201
**RADON 222**
**Environmental Transport**
Radon emanation over an orebody: search for long-distance transport of radon, 7:150
**Radiation Monitoring**
$^{226}$Ra- and $^{222}$Rn-content of drinking water, 7:1049
Monitoring of environmental radon-222 in selected areas of Taiwan Province of the Republic of China, 7:994
**RAJASTHAN-1 REACTOR**
**Fuel Element Clusters**
Fuel bundle end plate analysis by code SPACE, 7:385
**Primary Coolant Circuits**
Thermal hydraulic analysis of Rajasthan Nuclear Power Station primary circuits, 7:394
**RAJASTHAN-2 REACTOR**
**Fuel Element Clusters**
Fuel bundle end plate analysis by code SPACE, 7:385
**Primary Coolant Circuits**
Thermal hydraulic analysis of Rajasthan Nuclear Power Station primary circuits, 7:394
**RANGER DEPOSIT**
**Geology**
Geologic setting of the East Alligator uranium deposits and prospects, 7:69
**Isotope Ratio**
Stable isotope study of three deposits in the Alligator Rivers Uranium Field, N.T., 7:77
**Mineralogy**
Mineralogy of the Jabiluka, Ranger, Koongarra and Nabarlek uranium deposits, 7:75
**RAPS-1 REACTOR**
*See RAJASTHAN-1 REACTOR*
**RAPS-2 REACTOR**
*See RAJASTHAN-2 REACTOR*
**RAPSODIE REACTOR**
**Post-Irradiation Examination**
Post-irradiation examination on fast reactor fuel elements in France, 7:409
**RARE EARTHS**
*See also CERIUM*
*DYSPROSIUM*
*ERBIUM*
*EUROPIUM*
*GADOLINIUM*
*HOLMIUM*
*LANTHANUM*
*LUTETIUM*
*NEODYMIUM*
*PRASEODYMIUM*
*PROMETHIUM*
*SAMARIUM*
*TERBIUM*
*THULIUM*
*YTTERBIUM*
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**RARE GASES**
*See also ARGON*
*HELIUM*
*KRYPTON*
*NEON*
*RADON*
*XENON*
**Ion-Atom Collisions**
Charge transfer cross sections of $Ne^{+}$ and $Ne^{++}$ in rare gases, 7:1398
**RATS**
**Radiation Syndrome**
Fractional composition of sulfurmucoids in rats at acute radiation sickness, 7:1206
**Radionuclide Kinetics**
Subcellular distribution of $^{239}$Pu in the liver of rat, mouse, Syrian and Chinese hamster, 7:1183
**Radiosensitivity**
Relation of mucoprotein metabolism with radiosensitivity of rat organism exposed to ultraviolet radiation, 7:1205
**REACTOR ACCIDENTS**
*See also FUEL ELEMENT FAILURE*
*LOSS OF COOLANT*
*MELTDOWN*
*TRANSIENT OVERPOWER ACCIDENTS*
**Emergency Plans**
Emergency planning and preparedness. Pre- and post-Three Mile Island, 7:566
Extent of emergency actions for the protection of the public after accidental activity releases from nuclear power plants, 7:567
**Environmental Impacts**
Proceedings of the seminar on radioactive releases and their dispersion in the atmosphere following a hypothetical reactor accident, Risoe, 22-25 April 1980, 7:995
**Fission Product Release**
Application of cost-effectiveness analysis to restrict the damage caused by accidental release of radioactive material to the environment, 7:570
**Simulation**
Extent of emergency actions for the protection of the public after accidental activity releases from nuclear power plants, 7:567
**REACTOR COMPONENTS**
*See also BREEDING BLANKETS*
*FUEL ELEMENTS*
*REACTOR CORES*
**Failure Mode Analysis**
Some aspects of the interaction between systems- and structural reliability, 7:578
**Failures**
2- and 3-dimensional elasto-plastic finite element analysis of an SENB fracture specimen, 7:461
**Mechanical Vibrations**
Vibration studies on a three-loop PWR internals model, 7:321
**Neutron Dosimetry**
Analysis and extension of the SAND-II code, 7:433 (EUR—6813(Vol.2))
**Physical Radiation Effects**
Evaluation of void swelling in irradiated L.M.F.B.R. components by density measurement, 7:414
**Seismic Effects**
Dynamic pressures in annulus-shaped pressure suppression pools of boiling water reactors generated by earthquake ground motions, 7:575

Seismic response analysis of nuclear power plant auxiliary mechanical equipment, 7:590

**Stress Analysis**

2- and 3-dimensional elasto-plastic finite element analysis of an SENB fracture specimen, 7:461

Nonlinear, dynamic, plastic component-support analysis, 7:329

**Valves**

Replacement of hard coating in nuclear values: results of testing of cobalt free valves, 7:457

**REACTOR CONTROL SYSTEMS**

*(The processes and operations ensuring the control and safe running of a nuclear reactor.)*

PROWAY - a standard for distributed control systems, 7:527 (AECL—7056)

**Design**

Intelligent safety system concept for future CANDU reactors, 7:546 (AECL—7056)

**Mechanical Vibrations**

Nuclear reactor surveillance - neutron noise measurements and vibration analysis on French PWR internal structures, 7:538

**REACTOR CONTROL THEORY**

*See REACTOR KINETICS*

**REACTOR CORES**

**Hydrodynamics**

Vibration of PWR internals considering their edge conditions and holes, 7:320

**Mechanical Tests**

Dynamic behavior of a PWR-core barrel. Analytical integration of the cylindrical shell equations, 7:582

**Mechanical Vibrations**

Two-dimensional vibration test and its simulation analysis for a horizontal slice model of HTGR core, 7:378

Vibration of PWR internals considering their edge conditions and holes, 7:320

**Multiplication Factors**

Technical problems in case of utilizing uranium of medium enrichment for a research reactor, 7:543 (KURRI-TR—192)

**Performance**

Technical problems in case of utilizing uranium of medium enrichment for a research reactor, 7:543 (KURRI-TR—192)

**Seismic Effects**

Evaluation of seismic movements of a pebble bed reactor core as basis for shaking experiments, 7:593

Forced vibration test of 1/5 scale model of Candu core, 7:596

**REACTOR FUEL ELEMENTS**

*See FUEL ELEMENTS*

**REACTOR FUELS**

*See NUCLEAR FUELS*

**REACTOR INSTRUMENTATION**

Continuous analyzers of hydrogen and carbon in liquid sodium and of hydrocarbon total in protective atmosphere above sodium, 7:405 (INIS-mf—6423)

**Flowmeters**

Utilization of thermocouple random signal correlation method for coolant flow rate measuring in nuclear power plants, 7:453

**Radiation Detectors**

Si reactor damage monitors and their application, 7:444 (EUR—6813(Vol.1))

**Thermocouples**

Utilization of thermocouple random signal correlation method for coolant flow rate measuring in nuclear power plants, 7:453

**REACTOR INTERNALS**

**Mechanical Vibrations**

Nuclear reactor surveillance - neutron noise measurements and vibration analysis on French PWR internal structures, 7:538

**REACTOR KINETICS**

**Cross Sections**

Analysis of the Winfrith iron benchmark experiment with DUCKPOND and comparison with the ANISN/SWANLAKE analysis, 7:440

**Mathematical Models**

Application of the method of characteristics to solution of nuclear engineering problems, 7:439

**Neutron Spectra**

Analysis and extension of the SAND-II code, 7:433 (EUR—6813(Vol.2))

Comparison of four neutron spectrum unfolding codes, 7:438 (EUR—6813(Vol.2))

Many channel spectrum unfolding, 7:435 (EUR—6813(Vol.2))

Multialgorithm unfolding studies of neutron spectra from activation detectors, 7:437 (EUR—6813(Vol.2))

Several applications of J1 unfolding method of multiple foil data to reactor dosimetry, 7:436 (EUR—6813(Vol.2))

Unfolding by least-squares methods: SAND-II, STAY'SL, 7:434 (EUR—6813(Vol.2))

**Perturbation Theory**

Analysis of the Winfrith iron benchmark experiment with DUCKPOND and comparison with the ANISN/SWANLAKE analysis, 7:440

**REACTOR MATERIALS**

*(See also specific materials.)*

*See also NUCLEAR FUELS*

**Cross Sections**

Preliminary version of the EURLIB variance-covariance matrices, 7:441

Simple comparison of adjusted data sets for iron based on measuremets in ASPIS and in the cores of fast reactor criticals, 7:415

**Fracture Properties**

2- and 3-dimensional elasto-plastic finite element analysis of an SENB fracture specimen, 7:461

**Physical Radiation Effects**

3-D inelastic analysis of HTR graphite structures and a comparison with A 2-D approach, 7:432

Benchmark referencing of neutron dosimetry measurements, 7:295 (EUR—6813(Vol.2))

**Service Life**

Life prediction of simple structures subject to cyclic primary and secondary loading resulting in creep and platicity, 7:379

**Test Facilities**

Equipment for long-term testing of material creep in liquid sodium, 7:398 (INIS-mf—6423)

**Thermal Cycling**

Life prediction of simple structures subject to cyclic primary and secondary loading resulting in creep and platicity, 7:379

**Thermal Stresses**

3-D inelastic analysis of HTR graphite structures and a comparison with A 2-D approach, 7:432

**REACTOR PROTECTION SYSTEMS**

**On-Line Control Systems**

Distributed systems for the protection of nuclear stations, 7:443 (AECL—7056)

**REACTOR SAFETY**

*(Theoretical and experimental investigations of the behavior of reactor types and designs under various real or hypothetical accidents.)*

**Meetings**

Proceedings of the second US-Japan seminar on HTGR safety technology, 1. General; accident delineation; helium technology, 7:601

Proceedings of the second US-Japan seminar on HTGR safety technology, 1. Material properties and design methods; seismic research, 7:602

**Recommendations**

Some radiation protection implications of the Three Mile Island incident, 7:563

**Risk Assessment**

Reactor safety, analysis and prognosis, 7:559

**REACTOR VESSELS**

Concrete for PCRV's: Mechanical properties at elevated temperatures and residual mechanical behaviour after triaxial preloading, 7:738

**Design**

Optimized reactor vessel utilizing large forged pieces, 7:309

**Mechanical Properties**

EDF's (Electricite de France) in service control for GCR type reactor vessels, 7:339 (IWGHTR—2)

**Stress Analysis**

Parametric study on ligament stresses in multi-cavity prestressed concrete reactor vessels (PCRV's), 7:372

**RECYCLE (FUEL)**
*See FUEL CYCLE*
**RED DWARF STARS**
**Stellar Atmospheres**
Atmospheric structure of the low-temperature stars, 7:1370
**REDOX FUEL CELLS**
**Optimization**
Comparison between flow-through and flow-by porous electrodes for redox energy storage, 7:635
**REDUCTASES**
*See OXIDOREDUCTASES*
**REFUSE**
*See SOLID WASTES*
**REINFORCED CONCRETE**
**Impact Tests**
Impact testing of steel fibre reinforced concrete slabs with liner, 7:376
**RELATIVISTIC PLASMA**
**Cyclotron Instability**
Relativistic effects in cyclotron instabilities, 7:1673 (INIS-mf—6424)
**RELEASE (FISSION PRODUCT)**
*See FISSION PRODUCT RELEASE*
**RELIEF VALVES**
**Seismic Effects**
Nonlinear transient dynamic response of pressure relief valves for a negative containment system, 7:392
**Stress Analysis**
Nonlinear transient dynamic response of pressure relief valves for a negative containment system, 7:392
**REMOTE HANDLING EQUIPMENT**
Combustion engineering comprehensive fuel inspection stand, 7:876
Computer controlled nondestructive testing on the irradiated fuel rod, 7:283
Experience with a servo-hydraulic mechanical testing machine installed in a new shielded active facility at Windscale Nuclear Power Development Laboratories, 7:861
Framatome's multiple examination device and on-site removable fuel rods examination stand, 7:877
In-cell refabrication of experimental fuel rods using rods pre-irradiated in a power reactor, 7:507
Some Windscale experience of the underwater examination of water reactor fuel assemblies, 7:284
**REMOTE VIEWING EQUIPMENT**
Optical devices for remote examination, 7:882
Remote handling and viewing for the future, 7:870
Some Windscale experience of the underwater examination of water reactor fuel assemblies, 7:284
**RENEWABLE ENERGY SOURCES**
*See also SOLAR ENERGY*
**Hearings**
Pacific basin energy, 7:629 (PUBL—96-145)
**RENIN**
**Radioimmunoassay**
Accuracy and sensitivity of plasma renin activity determination, 7:1054 (INIS-mf—6419)
Determining normal values of plasma renin activity in children, 7:1055 (INIS-mf—6419)
**REPUBLIC OF KOREA**
**Energy Policy**
Study on the future nuclear power development strategy in Korea, 7:622
**Nuclear Power**
Study on the future nuclear power development strategy in Korea, 7:622
**RESEARCH AND TEST REACTORS**
*See also RESEARCH REACTORS*
**Fuel Elements**
Technical problems in case of utilizing uranium of medium enrichment for a research reactor, 7:543 (KURRI-TR—192)
**Reactor Cores**
Technical problems in case of utilizing uranium of medium enrichment for a research reactor, 7:543 (KURRI-TR—192)
**RESEARCH REACTORS**
*See also CIRUS REACTOR*
*TAPIRO REACTOR*
**Data Acquisition Systems**
Distributed terminal support in a data acquisition system for nuclear research reactors, 7:536 (AECL—7056)
**RESERVOIR ROCK**
**Geochemistry**
Oils and source rocks of the North Sea area, 7:25
**Permeability**
Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland, 7:57
**Petrography**
Geology of the Morecambe gas field, 7:56
**Porosity**
Geology of the Kinsale Head Gas Field, Celtic Sea, Ireland, 7:57
**RESIDENTIAL BUILDINGS**
*See also HOUSES*
**Energy Conservation**
High cost of heat: a new threat to city neighborhoods, 7:636 (PAS—349)
**RESIDUES (RADIOACTIVE)**
*See RADIOACTIVE WASTES*
**RESOURCE CONSERVATION**
Dynamic aspects of soil organic matter and its relationship to the physical properties and fertility of soils, 7:1123 (IAEA-TECDOC—236)
**RESTRAINTS**
**Impact Shock**
Study and measurement of impact damping in PWR reactor coolant system seismic and accident restraints, 7:325
**Stress Analysis**
Study and measurement of impact damping in PWR reactor coolant system seismic and accident restraints, 7:325
**REVERSE-FIELD PINCH**
**Breeding Blankets**
Engineering design of a direct-cycle steam-generating blanket for a long-pulse fusion reactor, 7:1702
**RHENIUM**
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**RHENIUM ALLOYS**
**Corrosion**
Corrosion behaviour of Ni-Re, Ni-Re-Mo, Ni-Re-Hf, Ni-Re-W-Hf alloys, 7:686
**RHO-765 RESONANCES**
**Particle Production**
Particle production in anti pp annihilation and non-annihilation, 7:1515
**RHYOLITES**
**Chemical Composition**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**Hydration**
Durability of rhyolitic obsidian glass inferred from hydration dating research, 7:714
**Leaching**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**Stability**
Nuclear waste glasses and volcanic glasses: a comparison of their stabilities, 7:715
**RIBONUCLEIC ACID**
*See RNA*
**RISOE NATIONAL LABORATORY**
**Spent Fuel Elements**
Computer based recording and handling of non-destructive PIE data at Risoe, 7:874
**RITAC DOSEMETERS**
*(Radiation induced thermally acitvated current.)*
**Neutron Dosimetry**
Thermoelectric neutron dosimetry: summary of recent results, 7:929 (EUR—6813(Vol.2))
**Performance**
Thermoelectric neutron dosimetry: summary of recent results, 7:929 (EUR—6813(Vol.2))
**RIVERS**
*See also DANUBE RIVER*

**Biogeochemistry**
Determination of biogeochemical and radioecological characteristics of the Vardar River system, 7:1040 (IAEA-TECDOC—229)
**Radioecology**
Determination of biogeochemical and radioecological characteristics of the Vardar River system, 7:1040 (IAEA-TECDOC—229)
**RNA**
*(Ribonucleic acid.)*
**Biosynthesis**
RNA biosynthesis in rabbit skeletal muscles in case of combined radiation injury, 7:1222
**ROCK BURSTS**
**Alarm Systems**
Evaluation of the microseismic technique for outburst warning at West Cliff Colliery, 7:5
**Forecasting**
Use of adsorption/desorption isotherms in predicting outburst conditions, 7:6
**Seismic Noise**
Evaluation of the microseismic technique for outburst warning at West Cliff Colliery, 7:5
**ROCKS**
*See also CAP ROCK*
*IGNEOUS ROCKS*
*METAMORPHIC ROCKS*
*RESERVOIR ROCK*
*SEDIMENTARY ROCKS*
*SYNTHETIC ROCKS*
**Activation Analysis**
Applications to archaeology. Chapter 5. Section 5, 7:759
X-ray spectrometry. Chapter 3. Section 2, 7:749
**Chemical Analysis**
Pine Creek Geosyncline. Statistical treatment of whole rock chemical data, 7:67
**Gamma Logging**
Possibility of determining rock massif stress by isotope methods, 7:1266 (INIS-mf—6422)
**Hysteresis**
Hysteresis behaviour of soils and rocks, 7:1269
**Multi-Element Analysis**
Analysis of gamma-ray spectra. Chapter 3. Section 1, 7:748
**ROCKY FLATS PLANT**
**Radiation Hazards**
Evaluation of cancer incidence for Anglos in the period 1969-1971 in areas of census tracts with measured concentrations of plutonium soil contamination downwind from the Rocky Flats Plant in the Denver standard metropolitan statistical area, 7:1195
**ROOF BOLTS**
**Stresses**
Investigation of a bolted coal mine roof during mining at Nattai North Colliery, 7:9
**ROOFS**
**Deformation**
Investigation of a bolted coal mine roof during mining at Nattai North Colliery, 7:9
**RUBIDIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Crystal Models**
Unified study of static and dynamic properties of alkali metals, 7:687
**RUBIDIUM 100**
**Beta Decay**
Decay properties of neutron-rich isotopes of Rb (Z = 37) to Tc (Z = 43) and the mass-energy surface around A = 100. Chapter 5, 7:1590
**RUBIDIUM 98**
**Beta Decay**
Decay properties of neutron-rich isotopes of Rb (Z = 37) to Tc (Z = 43) and the mass-energy surface around A = 100. Chapter 5, 7:1590
**RUBIDIUM 99**
**Beta Decay**
Decay properties of neutron-rich isotopes of Rb (Z = 37) to Tc (Z = 43) and the mass-energy surface around A = 100. Chapter 5, 7:1590
**RUMEN**
*See STOMACH*
**RUPTURE DISKS**
*See RELIEF VALVES*

## S

**SACLAY (CEA)**
*See CEA SACLAY*
**SAFETY ENGINEERING**
Opening lecture, 7:1710
**Standardization**
Acknowledged rules of technology as a legal term in public law, 7:1711
Relationship between technical standards and legal norms, with special regard to the building law, 7:1712
**SALT DEPOSITS**
**Chemical Analysis**
Laboratory investigation of water content within rock salt and its behavior in a temperature field of disposed high-level waste, 7:196
**Radiation Effects**
Experimental evaluation of changes in properties of natural minerals under irradiation, 7:215
**Radionuclide Migration**
Analysis on the use of engineered barriers for geologic isolation of spent fuel, 7:238
**Thermal Conductivity**
Thermal conductivity of selected repository minerals, 7:197
**SALTS**
**Latent Heat Storage**
Thermal storage in salt-hydrates, 7:268
**Thermodynamic Properties**
Thermal storage in salt-hydrates, 7:268
**SAMARIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**SAMARIUM 144**
Investigation of the formation of atomic complexes in the spark ion source by the use of stable isotope tracers, 7:771
**SAMARIUM 151**
**Energy Levels**
Negative parity states of $^{151}$Sm in the particle-rotor model with exact treatment of the pairing and recoil term, 7:1593 (OUP—81-09)
**SAND**
**Sorptive Properties**
Sorption studies of $H^{14}CO_3^-$ on some geologic media and concrete, 7:216
**SANDSTONES**
**Geology**
Anomalous orebody within the Ambrosia Lake trend at Sandstone Mine, 7:142
**Oxidation**
Tertiary oxidation in Westwater Canyon member of Morrison formation, 7:1262
**Petrography**
Geology and development of Marquez, New Mexico, uranium deposit, 7:143

**SANITARY LANDFILLS**
**Environmental Effects**
Sulfur gas emissions from stored flue gas desulfurization sludges, 7:1005
**Waste Management**
Sulfur gas emissions from stored flue gas desulfurization sludges, 7:1005
**SASKATCHEWAN**
**Uranium Deposits**
Athabasca basin unconformity-type uranium deposits. A special class of sandstone-type deposits, 7:87
Comparison of exploration techniques in Saskatchewan and the Northern Territory, 7:135
Contribution to some Saskatchewan uranium deposits mainly from fluid inclusion and isotopic data, 7:90
Genetic models and their impact on uranium exploration in the Athabasca sandstone basin, Saskatchewan, Canada, 7:133
Key Lake U-Ni deposits. A model for Lower Proterozoic uranium deposition, 7:89
Stratigraphic implications of uranium deposits, 7:101
**SATURN PLANET**
**Albedo**
Correlated variations of planetary albedos and solar-interplanetary parameters, 7:1313
**SAUDI ARABIA**
**Geology**
Isotope methods as a tool for Quaternary studies in Saudi Arabia, 7:1025
**Ground Water**
Environmental isotopes in North African groundwaters; and the Dahna sand-dune study, Saudi Arabia, 7:1016
**Hydrology**
Conceptual hydrochemical model for alluvial aquifers on the Saudi Arabian basement shield, 7:1024
Isotope methods as a tool for Quaternary studies in Saudi Arabia, 7:1025
**SCANDIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Multi-Element Analysis**
Analysis of gamma-ray spectra. Chapter 3. Section 1, 7:748
**SCANDIUM 43**
**Energy-Level Transitions**
Collective bands of positive parity states in (FP) shell nuclei, 7:1586
**SCANDIUM ALLOYS**
**Superconductivity**
Superconductivity in scandium-zirconium systems, 7:1655
**SCATTERING AMPLITUDES**
**DWBA**
Evaluation of relativistic and nonrelativistic DWBA scattering amplitude using wave functions calculated with the help of Green's function, 7:1630
**SCHMEHAUSEN THTR REACTOR**
*See THTR-300 REACTOR*
**SCHNELLER NATRIUMGEKUEHLTER REAKTOR**
*See SNR-1 REACTOR*
**SCHOOL BUILDINGS**
**Heating Systems**
Operating experience with a fluidized bed steam generator at Georgetown University, 7:905 (CONF-8004173—11)
**SCINTILLATION COUNTERS**
*See also SOLID SCINTILLATION DETECTORS*
**Calibration**
'Intelligent' radiation instruments, 7:954
**Efficiency**
Detection efficiency of scintillator gels, 7:956
**Microprocessors**
'Intelligent' radiation instruments, 7:954
**SEA DISPOSAL**
*See MARINE DISPOSAL*
**SEALED SOURCES**
**Radiation Hazards**
Radiation hygiene working conditions and health state of the personnel dealing with sealed radioactive materials (Sealed sources: $^{60}$Co, $^{226}$Ra, Po-Be sources), 7:1234
**SEAWATER**
**Contamination**
Studies of concentration and transfer factors of natural and artificial actinide elements in a marine environment, 7:1048
**Radionuclide Migration**
Mobility and retention of $^{60}$Co in soils in coastal areas, 7:1046
Studies of concentration and transfer factors of natural and artificial actinide elements in a marine environment, 7:1048
**SEBACEOUS GLANDS**
*See SKIN*
**SECONDARY COOLANT CIRCUITS**
**Pipes**
Experimental studies of PWR secondary piping in case of steam break, 7:328
**SECONDS LIVING RADIOISOTOPES**
**Activation Analysis**
Measurement of very short-lived nuclides. Chapter 3. Section 4, 7:751
**SEDIMENTARY ROCKS**
*See also SANDSTONES*
**Chemical Composition**
Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
**Geochemistry**
Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
**Paleontology**
Palynology, its biostratigraphic and environmental potential, 7:1249
**Stratigraphy**
Palynology, its biostratigraphic and environmental potential, 7:1249
**SEDIMENTS**
**Diagenesis**
Refinement of the geological model of the Thistle Field, 7:38
**Geologic History**
Integration of palynological and sedimentological methods in facies analysis of the Brent Formation, 7:29
**Mineralogy**
Refinement of the geological model of the Thistle Field, 7:38
**Origin**
Evolution of sedimentary basins in northwest Europe, 7:14
**Radioactivity**
Radionuclide accumulation in selected components of the aquatic fauna of the Czechoslovak Danube River section, 7:1042 (IAEA-TECDOC—229)
**Radiochemical Analysis**
Radiological analysis of the river system of the upper Danube, 7:1037 (IAEA-TECDOC—229)
**Radionuclide Migration**
Mobility and retention of $^{60}$Co in soils in coastal areas, 7:1046
Studies of concentration and transfer factors of natural and artificial actinide elements in a marine environment, 7:1048
**Sorptive Properties**
Methodology used for the study of sorption properties of bottom sediments and some basic information on the behaviour of selected radionuclides in aqueous media, 7:1036 (IAEA-TECDOC—229)
**SEISMIC NOISE**
**Monitoring**
Evaluation of the microseismic technique for outburst warning at West Cliff Colliery, 7:5
**SELF-POWERED NEUTRON DETECTORS**
**Performance**
Properties and application of self-powered neutron detectors, 7:928 (EUR—6813(Vol.2))
**Sensitivity**
Properties and application of self-powered neutron detectors, 7:928 (EUR—6813(Vol.2))
**SEMICONDUCTOR MATERIALS**
*(See also specific semiconductor materials.)*
**Crystal Structure**
Low-energy ion source for p-type doping in MBE, 7:729
**Ion Implantation**
Advances and limitations of commercial ion-implantation equipment, 7:916
High-current ion implanter for industrial use, 7:1387

Low-energy ion source for p-type doping in MBE, 7:729
**Physical Radiation Effects**
Radiation damage in non-metals, 7:835 (AERE-TP—843)
**SEPTICEMIA**
**Biological Effects**
Permeability state of microcirculatory channel of some organs in rabbits under conditions of pyocyanic infections process, 7:1121
**SERUM (BLOOD)**
*See BLOOD SERUM*
**SEWAGE SLUDGE**
**Briquetting**
Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge, 7:638 (NYSERDA—81-6)
**Waste Disposal**
Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge, 7:638 (NYSERDA—81-6)
**SGHWR REACTOR**
**Fuel Elements**
Probabilistic evaluation of fuel element performance by the combined use of a fast running simplistic and a detailed deterministic fuel performance code, 7:485 (IWGFPT—7)
**SHEATHS (FUEL)**
*See FUEL CANS*
**SHELL MODELS**
*See also INTERACTING BOSON MODEL*
Multi-centre shell model, 7:1631
**SHELLS**
**Creep**
Creep buckling and instability of circular cylindrical shells in axial compression, 7:468
**Plasticity**
Dynamic plastic buckling of shells. A reconsideration of the Vaughan-Florence analysis, 7:598
**SHELLS (CONTAINMENT)**
*See CONTAINMENT SHELLS*
**SHIELDING**
Review of ANS special session on radiation streaming in power reactors (PWR), 7:296 (EUR—6813(Vol.2))
**Benchmarks**
Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, 7:1642
**Cross Sections**
Preliminary version of the EURLIB variance-covariance matrices, 7:441
Simple comparison of adjusted data sets for iron based on measuremets in ASPIS and in the cores of fast reactor criticals, 7:415
**Meetings**
Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, 7:1642
**Neutron Spectra**
Few-channel unfolding in shielding - the SENSAK code, 7:1638 (EUR—6813(Vol.2))
**Nuclear Data Collections**
Proceedings of specialist's meeting on nuclear data and benchmarks for reactor shielding, 7:1642
**SHIPMENT**
*See TRANSPORT*
**SHREWS**
**Radionuclide Kinetics**
Retention and effects of $^{239}$Pu in the tree shrew (Tupaia Belangeri), 7:1182
**SILICON**
**Absorption Spectroscopy**
Stable product low leach glasses, 7:202
**Activation Analysis**
Oxidation kinetics and spallation of oxide film of the structural metal in helium under thermal cycles, 7:681
**Amorphous State**
Introduction to basic aspects of plasma-deposited amorphous semiconductor alloys in photovoltaic conversion, 7:257
**Crystal Doping**
Problems of producing homogeneously doped silicon by neutron irradiation, 7:713 (INIS-mf—6449)
**Electrical Properties**
Properties of amorphous hyrogenated silicon, with special emphasis on preparation by sputtering, 7:251
**Hydrogen Additions**
Introduction to basic aspects of plasma-deposited amorphous semiconductor alloys in photovoltaic conversion, 7:257
Properties of amorphous hyrogenated silicon, with special emphasis on preparation by sputtering, 7:251
**Leaching**
Stable product low leach glasses, 7:202
**Neutron Reactions**
First results in evaluation of neutron nuclear data for Si, 7:1585 (ZfK—410)
**Optical Properties**
Properties of amorphous hyrogenated silicon, with special emphasis on preparation by sputtering, 7:251
**Plasma Arc Spraying**
Introduction to basic aspects of plasma-deposited amorphous semiconductor alloys in photovoltaic conversion, 7:257
**Spectrophotometry**
Analysis of uranium and some of its compounds and alloys. Silicon spectrophotometric determination, 7:794 (CEA-CETAMA—7)
Analysis of uranium and some of its compounds or alloys. Silicon trace spectrophotometric determination, 7:795 (CEA-CETAMA—7)
Uranium tetrafluoride analysis. Silicon spectrophotometric determination, 7:810 (CEA-CETAMA—7)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
**Sputtering**
Properties of amorphous hyrogenated silicon, with special emphasis on preparation by sputtering, 7:251
**SILICON 28 TARGET**
**Neutron Reactions**
First results in evaluation of neutron nuclear data for Si, 7:1585 (ZfK—410)
**SILICON 29 TARGET**
**Proton Reactions**
Combined analysis of the angular correlations in the (p,γ) and (p,p'γ) reactions, 7:1584 (KFTI—79-40)
**SILICON ALLOYS**
**Physical Radiation Effects**
Calculation of the driving force for the radiation induced precipitation of $Ni_3Si$ in nickel-silicon alloys, 7:673
**SILICON DIODES**
**Physical Radiation Effects**
Si reactor damage monitors and their application, 7:444 (EUR—6813(Vol.1))
**SILICON NITRIDES**
**Physical Radiation Effects**
Metamictization by heavy ion bombardment of α-quartz, zircon, monazite and nitride structures (3 MeV ion beams), 7:719
**SILICON SOLAR CELLS**
**Efficiency**
High efficiency silicon cells for luminescent solar concentrators, 7:250
**Grain Boundaries**
Optimization of solar conversion devices, 7:256
**Luminescent Concentrators**
High efficiency silicon cells for luminescent solar concentrators, 7:250
**SILVER**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701

**Ion Collisions**
Inner shell ionization in the collision system of $Z_1 << Z_2$, 7:1401
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**SILVER ALLOYS**
**Physical Radiation Effects**
Dynamic surface composition changes in Ag-Pd alloys under ion bombardment at different ion energies, 7:657
**SIMPLEX PROCESS**
**Technology Assessment**
Adaptation of the Simplex gasification process to the co-conversion of municipal solid waste and sewage sludge, 7:638 (NYSERDA—81-6)
**SINGLE CRYSTALS**
*See MONOCRYSTALS*
**SKELETAL DISEASES**
*See also BONE FRACTURES*
**Radiotherapy**
X-ray therapy of calcaneal spur, 7:1238
**SKELETON**
*See also FEMUR*
*TIBIA*
*VERTEBRAE*
**Calcium**
Comparison of bone resorption and bone-blood calcium equilibrium in vertebrates, 7:1081
**Dynamic Function Studies**
Measurement of the bone apposition rate by simultaneous labelling of bone formation sites with $^3H$ proline and tetracycline, 7:1077
**Metabolism**
Delayed stimulatory effect of cyclic AMP on bone resorption, 7:1075
**Radionuclide Kinetics**
Stimulation of $^{45}Ca$ release from bone by embryonic chick parathyroid glands in vitro, 7:1175
**SKIN**
*See also HAIR*
**Ultrastructural Changes**
Metabolism breakage of non-collagenous proteins and skin ultrastructure of rats in case of its local radiation acute injury, 7:1225
**SLIME FUNGI**
*See MYXOMYCETES*
**SLUGS (FUEL)**
*See FUEL RODS*
**SM-2 REACTOR**
**In Core Instruments**
Peculiarities of investigations in reactor channels, 7:541 (KFTI—78-64)
**Reactor Experimental Facilities**
Peculiarities of investigations in reactor channels, 7:541 (KFTI—78-64)
**SNR REACTOR**
*See SNR-1 REACTOR*
**SNR-1 REACTOR**
**Steam Generators**
Experimental determination of density-wave oscillations in full-scale sodium-heated steam generators, 7:422
**SNR-300 REACTOR**
*See SNR-1 REACTOR*
**SODA ASH**
*See SODIUM CARBONATES*
**SODIUM**
**Absorption Spectroscopy**
Stable product low leach glasses, 7:202
**Corrosive Effects**
Effect of liquid sodium on behaviour of selected structural materials for steam generators of fast power reactors, 7:648 (INIS-mf—6423)
**Crystal Models**
Unified study of static and dynamic properties of alkali metals, 7:687
**Ion Collisions**
Inner shell ionization in the collision system of $Z_1 << Z_2$, 7:1401
**Leaching**
Stable product low leach glasses, 7:202
**Multi-Element Analysis**
Analysis of gamma-ray spectra. Chapter 3. Section 1, 7:748
**Quantitative Chemical Analysis**
Sodium sampling and impurities determination, 7:741 (INIS-mf—6423)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**SODIUM 22**
**Leaching**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209
**SODIUM CARBONATES**
**Chemical Reactions**
Precipitation of radiostrontium in soil, 7:1008
**SODIUM CHLORIDES**
**Crystal Models**
Polarisable dipole models for ionic solids and their quantum mechanical justification, 7:735
**Solvent Properties**
$SrCl_2$ solubility in complex brines, 7:814
**Sputtering**
Temperature dependence of sputtering rate of alkali halides by $Ar^+$ bombardment, 7:1427
**SODIUM COMPOUNDS**
**Chemical Reactions**
Precipitation of radiostrontium in soil, 7:1008
**SODIUM FLUORIDES**
**Chemical Reactions**
Precipitation of radiostrontium in soil, 7:1008
**SODIUM OXIDES**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**SODIUM PHOSPHATES**
**Chemical Reactions**
Precipitation of radiostrontium in soil, 7:1008
**SODIUM SILICATES**
**Chemical Reactions**
Precipitation of radiostrontium in soil, 7:1008
**SODIUM SULFATES**
**Specific Heat**
High-temperature thermodynamic properties of aqueous sodium sulfate solutions, 7:812
**Thermodynamic Properties**
High-temperature thermodynamic properties of aqueous sodium sulfate solutions, 7:812
**SOFT X RADIATION**
**X-Ray Detection**
Observation of soft x-ray and hard x-ray by the satellite Hakucho, 7:1371
**SOIL CONSERVATION**
Contribution of the Land and Water Development Division of FAO to soil and water conservation in developing countries, 7:1129 (IAEA-TECDOC—236)
Dynamic aspects of soil organic matter and its relationship to the physical properties and fertility of soils, 7:1123 (IAEA-TECDOC—236)
**Tracer Techniques**
Isotope versus the total balance method to assess nutrient losses and erosion risks, 7:1122 (IAEA-TECDOC—236)
**SOIL MECHANICS**
Model for soil behavior under monotonic and cyclic loading conditions, 7:1270
**SOILS**
**Contamination**
Evaluation of cancer incidence for Anglos in the period 1969-1971 in areas of census tracts with measured concentrations of plutonium soil contamination downwind from the Rocky

Flats Plant in the Denver standard metropolitan statistical area, 7:1195
**Erosion**
Isotope versus the total balance method to assess nutrient losses and erosion risks, 7:1122 (IAEA-TECDOC—236)
**Fertility**
Dynamic aspects of soil organic matter and its relationship to the physical properties and fertility of soils, 7:1123 (IAEA-TECDOC—236)
Soil erosion, fertility and water conservation factors in agricultural activities in Kenya: A look at problems and efforts being made to solve them using radioisotope techniques, 7:1128 (IAEA-TECDOC—236)
**Hydraulics**
Injected gamma-tracer method for soil-moisture movement investigations in arid zones, 7:1003
**Hysteresis**
Hysteresis behaviour of soils and rocks, 7:1269
**Moisture**
Remote assessment of soil moisture, 7:1124 (IAEA-TECDOC—236)
Research techniques in soil moisture regimes under rain-fed agriculture, 7:1125 (IAEA-TECDOC—236)
**Multi-Element Analysis**
Forensic applications. Chapter 5. Section 6, 7:760
**Productivity**
Effect of desertification and soil salinity on land productivity in the Sudan, 7:1127 (IAEA-TECDOC—236)
**Radionuclide Migration**
Injected gamma-tracer method for soil-moisture movement investigations in arid zones, 7:1003
Precipitation of radiostrontium in soil, 7:1008
Remote sensing of soil radionuclide fluxes in a tropical ecosystem, 7:1007
**Sorptive Properties**
Precipitation of radiostrontium in soil, 7:1008
**SOLAR ABSORBERS**
**Design**
Optical properties-microstructure relationship in particulate media: optical tailoring of solar absorbers, 7:262
**Optical Properties**
Optical properties-microstructure relationship in particulate media: optical tailoring of solar absorbers, 7:262
**SOLAR ACTIVITY**
*See also SOLAR FLARES*
*SOLAR PROMINENCES*
*SOLAR RADIO BURSTS*
*SOLAR WIND*
*SOLAR X-RAY BURSTS*
**Magnetic Fields**
Evidence for open field lines from active regions: short communication, 7:1331
**SOLAR ATMOSPHERE**
**Force-Free Magnetic Fields**
False equilibrium of a force-free magnetic field, 7:1333
**Hydrodynamics**
Gasdynamics of impulsive heated solar plasma, 7:1360
**Magnetohydrodynamics**
Physical driving-forces and models of coronal responses, 7:1354
**SOLAR CELLS**
*See also CONCENTRATOR SOLAR CELLS*
*SILICON SOLAR CELLS*
**Films**
Research and device problems in photovoltaics, 7:254
**Heterojunctions**
Heterojunctions for thin film solar cells, 7:255
**Materials**
Solar Materials Science, 7:260
**Research Programs**
Research and device problems in photovoltaics, 7:254
**Reviews**
Introduction to photovoltaics: physics, materials and technology, 7:253
Research and device problems in photovoltaics, 7:254
**SOLAR COLLECTORS**
*See also CONCENTRATING COLLECTORS*
**Materials**
Introduction to Solar Materials Science, 7:261
Solar Materials Science, 7:260
**Solar Tracking**
Solar tracking system, 7:259 (NASA-CASE-MFS—23999-1)
**SOLAR CORONA**
**Brightness**
Possibility of identifying coronal holes on synoptic maps of the green corona, 7:1296
**Extreme Ultraviolet Radiation**
Measurements of mass flow in the transition region and inner corona, 7:1345
**Force-Free Magnetic Fields**
Energy storage and instability in magnetic flux tubes, 7:1334
**Hydromagnetic Waves**
Mode-coupled MHD waves in the corona and solar wind, 7:1307
**Magnetic Fields**
Cross sectional magnetic profile of a coronal transient, 7:1357
Evolution of coronal magnetic structures, 7:1358
Origin of interplanetary sectors, 7:1299
**Magnetohydrodynamics**
Dynamics of coronal transients: two-dimensional non-plane MHD models, 7:1361
Magnetically driven motions in solar corona, 7:1359
**Mathematical Models**
Stellar mass flux and coronal heating by shock waves, 7:1304
**Radiowave Radiation**
Proposal for an interplanetary mission to sound the outer regions of the solar corona, 7:1365
Radio observations of coronal holes, 7:1294
**Shock Waves**
Propagation of an MHD shock in the vicinity of a magnetic neutral sheet, 7:1341
Radio data and computer simulations for shock waves generated by solar flares, 7:1329
**Soft X Radiation**
X-ray evidence of coronal preflare emission, 7:1316
**Solar Radio Bursts**
Association of type III bursts and coronal transient activity, 7:1346
Radio data and computer simulations for shock waves generated by solar flares, 7:1329
**Star Models**
Model for the north coronal hole observed at the 1973 eclipse, between 1.3 and 3.2 solar radii, 7:1295
**Transients**
Decameter radio and white light observations of the 21 August 1973 coronal transient, 7:1328
Reconnection driven coronal transients, 7:1340
Solar mass ejection of 8 May 1979, 7:1348
Theoretical interpretation of traveling interplanetary phenomena and their solar origins, 7:1355
Transient disturbances of the outer corona, 7:1343
**Variations**
Coronal responses of the large-scale and long-term phenomena of the lower layers of the Sun, 7:1302
**Visible Radiation**
Possibility of identifying coronal holes on synoptic maps of the green corona, 7:1296
Solar observations with a new Earth-orbiting coronagraph, 7:1297
**Wave Propagation**
Propagation of an MHD shock in the vicinity of a magnetic neutral sheet, 7:1341
**X Radiation**
X-ray structures associated with disappearing Hα filaments in active regions, 7:1298
**SOLAR ELECTRONS**
**Acceleration**
Model for impulsive electron acceleration to energies of tens of kTsub(e), 7:1336
**Energy Spectra**
Development and energy of the solar flare on November 22, 1977, 7:1286 (INIS-mf—6385)
**SOLAR ENERGY**
**Research Programs**
Oversight: DOE solar and conservation programs, 7:627 (GPO—65-855)

**SOLAR ENERGY CONVERSION**
**Materials**
Introduction to Solar Materials Science, 7:261
Solar Materials Science, 7:260
**SOLAR FLARES**
**Electron Emission**
Recent observations of energetic electrons in solar flares, 7:1324
**Electron Temperature**
Emission energy of optical solar flares of different power, 7:1285 (INIS-mf—6385)
**Fine Structure**
Energy of large solar and discrete structure of geoeffective solar corpuscular fluxes, 7:1283 (INIS-mf—6385)
**Flow Models**
Model of surge, 7:1338
**Force-Free Magnetic Fields**
Flare model with force-free fields and helical symmetry, 7:1332
**Hydrodynamics**
Radiative hydrodynamics of flares: preliminary results and numerical treatment of the transition region, 7:1339
**Kinetic Energy**
Energy and mass injected by flares and eruptive prominences, 7:1315
Energy storage process and energy budget of solar flares, 7:1325
**Magnetic Field Configurations**
Flare associated eruptive prominence activity of February 1, 1979, 7:1326
**Magnetic Fields**
Energy storage process and energy budget of solar flares, 7:1325
Filament eruption in the 3B flare of July 29, 1973: onset and magnetic field configuration, 7:1320
Particle acceleration in the process of eruptive opening and reconnection of magnetic fields, 7:1322
Reconnection driven coronal transients, 7:1340
**Mathematical Models**
Model flare and the continued post-flare mass release from the flare region, 7:1337
**Microwave Radiation**
Thermalisation of flare-time energetic electrons observed at radio and X-ray wavelengths, 7:1323
**Solar Electrons**
Recent observations of energetic electrons in solar flares, 7:1324
**SOLAR HEATING SYSTEMS**
**Thermochemical Processes**
Application of reversible chemical reactions to solar thermal energy systems, 7:270
**SOLAR PROMINENCES**
**Balmer Lines**
Dynamics of a quiescent filament, 7:1321
**Emission Spectra**
Peculiar type of filament activation, 7:1319
**Extreme Ultraviolet Radiation**
Disruption of EUV coronal loops following a mass ejection transient, 7:1327
UV emitting spicules, 7:1318
**Instability**
Filament instability in a sheared field, 7:1335
**Mathematical Models**
Spicules and macrospicules, 7:1317
**SOLAR PROTONS**
**Energy Spectra**
Development and energy of the solar flare on November 22, 1977, 7:1286 (INIS-mf—6385)
**Proton Spectra**
Change of a time profile in solar cosmic ray events during magnetic storms, 7:1384 (INIS-mf—6290)
**SOLAR RADIATION**
**Plasma Diamagnetism**
Electromagnetic properties of a cosmic ray gas and diamagnetism of solar cosmic rays in magnetic traps, 7:1280 (INIS-mf—6385)
**SOLAR RADIO BURSTS**
**Emission Spectra**
Recent very bright type IV solar metre-wave radio emissions, 7:1347
**Fine Structure**
Estimation of shock thickness from dynamic spectra of type II bursts, 7:1330
**Microwave Radiation**
Radio and x-ray observations of a multi-spike impulsive burst with high time resolution, 7:1367
Thermalisation of flare-time energetic electrons observed at radio and X-ray wavelengths, 7:1323
**SOLAR REFLECTORS**
**Materials**
Solar mirror materials: their properties and uses in solar concentrating collectors, 7:263
**Optical Properties**
Solar mirror materials: their properties and uses in solar concentrating collectors, 7:263
**SOLAR TRACKING**
Solar tracking system, 7:259 (NASA-CASE-MFS—23999-1)
**SOLAR WIND**
Two classes of fast solar wind streams: their origin and influence on the galactic cosmic ray intensity, 7:1350
**Computerized Simulation**
Physical processes and models of interplanetary responses: suggested theoretical studies, 7:1356
**Electron Collisions**
Model calculations of solar wind expansion including an enhanced fraction of ionizing electrons, 7:1312
**Energy Transfer**
Energy exchange between cosmic rays and the solar wind, 7:1281 (INIS-mf—6385)
**Flow Models**
Two-fluid theory of interplanetary shock waves, 7:1342
**Hydromagnetic Waves**
Mode-coupled MHD waves in the corona and solar wind, 7:1307
Properties of magnetohydrodynamic turbulence in the solar wind, 7:1308
**Mathematical Models**
Model calculations of solar wind expansion including an enhanced fraction of ionizing electrons, 7:1312
Stellar mass flux and coronal heating by shock waves, 7:1304
**Proton Density**
Are solar wind measurements of different spacecraft consistent, 7:1310
**Spatial Distribution**
Coronal structure and solar wind, 7:1300
**Supersonic Flow**
Empirical relation between density, flow velocity and heliocentric distance in the solar wind, 7:1309
**SOLAR X-RAY BURSTS**
**Microwave Radiation**
Radio and x-ray observations of a multi-spike impulsive burst with high time resolution, 7:1367
**Plasma Heating**
Substance ejection and shock waves on solar plasma pulsed heating, 7:1284 (INIS-mf—6385)
**Shock Waves**
Substance ejection and shock waves on solar plasma pulsed heating, 7:1284 (INIS-mf—6385)
**SOLENOIDS**
**Performance**
Characteristics of superconducting solenoid with detachable current leads, 7:1659
**SOLID SCINTILLATION DETECTORS**
**Comparative Evaluations**
Imaging properties of a positron tomography with 280 bgo crystals, 7:1086
**SOLID STATE LASERS**
Advanced lasers for fusion, 7:1676
**SOLID WASTES**
*See also MINERAL WASTES*
**Leaching**
Influence of surface processes in waste form leaching, 7:214

**SOLIDS**
**Crystal Defects**
Introduction to the role of crystal defects in solar materials, 7:641
**Interfaces**
Surface and interface studies and the stability of solid solar energy materials, 7:642
**Physical Radiation Effects**
Foundations of the imitation theory of reactor damages of materials using heavy ion accelerators, 7:1641 (KFTI—79-65)
Nuclear track production in solids, 7:711
**Stability**
Surface and interface studies and the stability of solid solar energy materials, 7:642
**Surface Properties**
Surface and interface studies and the stability of solid solar energy materials, 7:642
**SOLID-STATE PLASMA**
**Equations of State**
Equation of state of one component Coulomb systems, 7:1647 (INIS-mf—6084)
**SOLUTION MINING**
**Technology Assessment**
Uranium solution mining: comparison of New Mexico with South Texas, 7:155
**SOMATOSTATIN**
**Radioimmunoassay**
Properties of labelled tyrosine analogs of somatostatine in RIA system, 7:1058 (INIS-mf—6419)
Radioiodination of tyrosine analogs of somatostatine: use of QUSO G 32 adsorbent, 7:1059 (INIS-mf—6419)
**SOMATOTROPIN RELEASE INHIBITING FACTOR**
*See SOMATOSTATIN*
**SOUTH CAROLINA**
**Radioactive Waste Disposal**
Low-level radioactive waste management: case studies on commercial burial sites, 7:189 (NP—2900893)
**Radioactive Waste Management**
Low-level radioactive waste management: case studies on commercial burial sites, 7:189 (NP—2900893)
**SOUTH KOREA**
*See REPUBLIC OF KOREA*
**SOUTH WEST AFRICA**
**Uranium Mines**
Roessing, a case history of economic and social benefits from uranium mining, 7:618
**SOYBEANS**
**Biological Radiation Effects**
Effect of gamma irradiation on the lysine content of plants, 7:1141 (INIS-mf—6050)
**SPACE HEATING**
**Cost**
High cost of heat: a new threat to city neighborhoods, 7:636 (PAS—349)
**SPACE LATTICES**
*See CRYSTAL LATTICES*
**SPAIN**
**Feed Materials Plants**
Mining of the uraniferous shales of Saelices el Chico (Salamanca), 7:152
**Uranium Deposits**
Mining of the uraniferous shales of Saelices el Chico (Salamanca), 7:152
**Uranium Mines**
Mining of the uraniferous shales of Saelices el Chico (Salamanca), 7:152
**SPARK MASS SPECTROMETERS**
**Tracer Techniques**
Investigation of the formation of atomic complexes in the spark ion source by the use of stable isotope tracers, 7:771
**SPECTRALLY SELECTIVE SURFACES**
**Comparative Evaluations**
Fundamental limits to the spectral selectivity of composite materials, 7:266
**Composite Materials**
Composite film selective-absorbers, 7:267
**Emissivity**
Fundamental limits to the spectral selectivity of composite materials, 7:266
**SPECTROMETERS**
*See also ALPHA SPECTROMETERS*
*GAMMA SPECTROMETERS*
*MASS SPECTROMETERS*
*MOESSBAUER SPECTROMETERS*
*X-RAY SPECTROMETERS*
**Electronic Circuits**
Single klystron superhet, E.S.R. spectrometer for low level and low frequency modulation, 7:971
**Nuclear Quadrupole Resonance**
NQR spectrometer with AGC and sideband suppression, 7:970
**Specifications**
NQR spectrometer with AGC and sideband suppression, 7:970
Single klystron superhet, E.S.R. spectrometer for low level and low frequency modulation, 7:971
**SPENT FUEL ELEMENTS**
**Eddy Current Testing**
Computer based recording and handling of non-destructive PIE data at Risoe, 7:874
Computer controlled nondestructive testing on the irradiated fuel rod, 7:283
Recent improvements in facilities for gamma-scanning and other non-destructive examinations of irradiated materials at ECN's hot cell plant L.S.O., 7:873
**Fission Product Release**
Apparatus for fission gas release measurements from HTGR fuel elements at very high temperatures, 7:356
Experimental investigation of release mechanisms responsible for airborne contamination seen during post-transport underwater unloading of a failed PWR spent fuel assembly, 7:297 (INIS-mf—6447)
**Gamma Fuel Scanning**
Computer based recording and handling of non-destructive PIE data at Risoe, 7:874
Computer controlled nondestructive testing on the irradiated fuel rod, 7:283
Recent improvements in facilities for gamma-scanning and other non-destructive examinations of irradiated materials at ECN's hot cell plant L.S.O., 7:873
Review and comments about gamma scanning analysis on PWR and FBR fuel elements, 7:511
**Inspection**
Combustion engineering comprehensive fuel inspection stand, 7:876
Framatome's multiple examination device and on-site removable fuel rods examination stand, 7:877
**Materials Testing**
Analytical procedures using instruments in the post-irradiation examination of fuels, 7:285
Automatic data collection in PIE, 7:340
Comprehensive post-irradiation examination of power reactor fuels and core component materials, 7:880
Fuel element and materials hot laboratory in Beijing, 7:881
Method of study applied to safety of post-irradiation facilities, 7:879
Neutron radiographic techniques in post-irradiation examination, 7:944
Post-irradiation examination at Radiometallurgy Division, BARC, Bombay, 7:341
Recent developments in post-irradiation examination techniques at Harwell, 7:878
**Mechanical Tests**
Equipment for mechanical piercing and free volume determination, 7:506
Hot cell installation for biaxial creep and burst testing of cladding specimens, 7:883
**Neutron Radiography**
Examination of fuel rods by means of neutron radiography, 7:515
Neutron radiographic techniques in post-irradiation examination, 7:944
**Nondestructive Testing**
Evolution of the equipment and recent developments in the alpha, beta, gamma-laboratory of the European Institute for Transuranium Elements, 7:875

**Post-Irradiation Examination**
Further developments in the non-destructive examination of irradiated fuel rods at Windscale, 7:512
Holographic post irradiation examination of AGR fuel elements, 7:345
In cell machines for the inspection of fast reactor fuel elements, 7:888
Post-irradiation examination on fast reactor fuel elements in France, 7:409
Post-irradiation wrapper measurements of irradiated PFR sub-assemblies at Dounreay, 7:410
Review of non-destructive testing techniques employed by the CEGB for the post-irradiation examination of Magnox and CAGR fuel, 7:346
**Remote Handling Equipment**
Combustion engineering comprehensive fuel inspection stand, 7:876
Computer controlled nondestructive testing on the irradiated fuel rod, 7:283
Framatome's multiple examination device and on-site removable fuel rods examination stand, 7:877
Some Windscale experience of the underwater examination of water reactor fuel assemblies, 7:284
System for PIE of irradiated fuel pins, employing minimal active volume and remotely controlled transport system, 7:872
**Remote Viewing Equipment**
Some Windscale experience of the underwater examination of water reactor fuel assemblies, 7:284
**Volume**
Equipment for mechanical piercing and free volume determination, 7:506
**X-Ray Radiography**
Application of the linear accelerator to radiographic inspection of irradiated fuel elements, 7:514
**SPENT FUEL STORAGE**
**Fission Product Release**
Investigation of the activity release from HTR fuel element spheres during storage, 7:355
**SPENT FUELS**
**Autoradiography**
Comparison between alpha autoradiography and some measured alpha emitting actinide profiles in a (UPu)C sphere-pac fuel, 7:517
**Chemical Analysis**
Post-irradiation chemical analysis of irradiated nuclear fuels, 7:509
**Fission Product Release**
Steady state fission gas kinetics in nuclear fuel at lower temperatures, 7:473 (IWGFPT—7)
**Gas Analysis**
Gas content measurements of irradiated coated particles using the PGA system, 7:747
**Land Transport**
Motor carrier routing using the COMPU.MAP program, 7:172 (INIS-mf—6447)
**Post-Irradiation Examination**
Contribution of post-irradiation examination to the development of AGR fuel, 7:343
Objectives and organisation of a national post-irradiation examination programme for commercial advanced gas-cooled reactor fuel, 7:344
Post-irradiation examination of light water reactor fuel. A United States perspective, 7:510
Post-irradiation examination techniques for CAGR fuel, 7:353
**Rail Transport**
Transport of spent light water reactor fuel by goods train. Estimation of potential release in the event of accidents, 7:173 (INIS-mf—6447)
**Road Transport**
Risk assessment for the transportation of $PuO_2$, $UF_6$ and spent fuel on roads in the Federal Republic of Germany, 7:176 (INIS-mf—6447)
Safety analysis on transportation of radioactive materials by truck in Japan, 7:174 (INIS-mf—6447)
**SPHENE**
**Comparative Evaluations**
Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
**Leaching**
Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
**Stability**
Stability of perovskite and sphene in the presence of backfill and repository materials: a general approach, 7:203
**SPICULES**
*See SOLAR PROMINENCES*
**SPINE**
*See VERTEBRAE*
**SPLEEN**
**Histology**
Nature of cell composition of spleen in cancer of different localization after radiotherapy, 7:1215
**Morphological Changes**
Structural and functional change peculiarities in immunocompetent organs during radiation injury in animals treated with αZ-macroglobulin, 7:1223
**SPLEEN CELLS**
**Biological Radiation Effects**
Morphological and biochemical changes in genesis of postradiation interphase cell killing, 7:1210
**SPOIL BANKS**
**Slope Stability**
Design of a large field shear box, 7:10
**SPORES**
*See also BACTERIAL SPORES*
**Paleontology**
Palynology, its biostratigraphic and environmental potential, 7:1249
**STAINLESS STEEL-304**
**Corrosion**
Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys, 7:683
**Fatigue**
Fatigue crack propagation under elastic plastic medium at elevated temperature, 7:664
Low cycle fatigue behaviour and cumulative damage effect of SA-516-70 steel at room and high temperature, 7:661
**Fracture Properties**
Fracture toughness of nitrogen strengthened austenitic steels at 4K, 7:674
**Permeability**
Radiation-enhanced permeation of $H_2$ in stainless steel, 7:658
**Phase Transformations**
Precipitation reactions in austenitic stainless steels, 7:166
**Physical Radiation Effects**
Radiation-enhanced permeation of $H_2$ in stainless steel, 7:658
**STAINLESS STEEL-304L**
**Phase Transformations**
Precipitation reactions in austenitic stainless steels, 7:166
**STAINLESS STEEL-310**
**Corrosion Resistance**
Corrosion resistance of Ni and Mo coated super alloy in He-high temperature environment, 7:682
**STAINLESS STEEL-316**
**Corrosion**
Compatibility of molten salts with type 316 stainless steel and lithium, 7:678
**Creep**
Results of study in long-term properties of austenitic steels in liquid sodium, 7:649 (INIS-mf—6423)
**Crystal-Phase Transformations**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**Fatigue**
Effect of long-term action of liquid sodium on resistance of steels 17346 and 17349 to low-cycle fatigue, 7:650 (INIS-mf—6423)
**Fracture Properties**
Fracture toughness of nitrogen strengthened austenitic steels at 4K, 7:674
**Phase Transformations**
Precipitation reactions in austenitic stainless steels, 7:166

**Physical Radiation Effects**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**Strain Hardening**
Modelization of the strain memory effect on the cyclic hardening of 316 stainless steel, 7:696
**STAINLESS STEEL-316L**
**Phase Transformations**
Precipitation reactions in austenitic stainless steels, 7:166
**STAINLESS STEEL-321**
**Crystal-Phase Transformations**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**Phase Transformations**
Precipitation reactions in austenitic stainless steels, 7:166
**Physical Radiation Effects**
Martensite formation and reversion and their effects on the void swelling of austenitic steels, 7:645
**STAINLESS STEEL-347**
**Phase Transformations**
Precipitation reactions in austenitic stainless steels, 7:166
**STAINLESS STEELS**
*STAINLESS STEEL-304*
*See also STAINLESS STEEL-304L*
*STAINLESS STEEL-310*
*STAINLESS STEEL-316*
*STAINLESS STEEL-321*
*STAINLESS STEEL-347*
**Corrosion**
Carbon deposition on 20/25/Nb steel using an electrically heated AGR fuel pin, 7:359
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
Effect of surface pretreatment on the growth of carbon onto stainless steel from the decomposition of propane, 7:825
Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358
**Melting Points**
Melting process to condition decladding hulls generated by the reprocessing of LWR and FBR spent fuels, 7:211
**Sputtering**
Response of stainless steel to the pellet debris in a laser fusion reactor, 7:1703
**STANDARDIZATION**
**Civil Liability**
Technical standards and quality assurance, 7:1714
**Legal Aspects**
Acknowledged rules of technology as a legal term in public law, 7:1711
Legal advantages for those complying with technical standards, 7:1715
Opening lecture, 7:1710
Relationship between technical standards and legal norms, with special regard to the building law, 7:1712
Standardization and workers' protection legislation, 7:1050
Standards and producers' liability, 7:1713
Technical standards and quality assurance, 7:1714
**Standardized Terminology**
Acknowledged rules of technology as a legal term in public law, 7:1711
**STAPHYLOCOCCUS**
**Radiosensitivity**
Para-hydroxybenzoic acid and a hypoxic radiosensitizer in bacterial cells, 7:1191
**STARCH**
**Chemical Radiation Effects**
Effect of ionizing radiation sterilization dose on some polysaccharides, 7:836 (INIS-mf—5673)
**STATE GOVERNMENT**
**Radioactive Waste Management**
High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state, 7:226 (NP—2900750)
**STATIC MASS SPECTROMETERS**
**Specifications**
Scanning ion source for static SIMS and depth profiling, 7:950
**STEAM GENERATING HEAVY WATER REACTOR**
*See SGHWR REACTOR*
**STEAM GENERATORS**
**Control Systems**
Control and operation of the SUPER PHENIX steam generators, 7:425
Dynamic analyses and control systems for steam generators in LMFBRs, 7:424
**Design**
High reliability straight tube LMFBR steam generator design, 7:418
**Fluidized-Bed Combustors**
Operating experience with a fluidized bed steam generator at Georgetown University, 7:905 (CONF-8004173—11)
**Instability**
Hydrodynamic stability tests and analytical model development for once-through sodium heated steam generator, 7:420
Prediction of dynamic stability limits of the 45MW scale model of SUPER PHENIX steam generator, 7:421
**Leak Detectors**
Continuous analyzers of hydrogen and carbon in liquid sodium and of hydrocarbon total in protective atmosphere above sodium, 7:405 (INIS-mf—6423)
**On-Line Control Systems**
Design development and commissioning of two distributed computer based boiler control systems, 7:533 (AECL—7056)
**Operation**
Control and operation of the SUPER PHENIX steam generators, 7:425
**Performance**
Operating experience with a fluidized bed steam generator at Georgetown University, 7:905 (CONF-8004173—11)
**Seismic Effects**
Seismic interaction effects for steam generators in CANDU 600 MWe nuclear power plants, 7:594
**Stability**
Experimental determination of density-wave oscillations in full-scale sodium-heated steam generators, 7:422
**STEEL-ASTM-A508**
**Fracture Properties**
Static and dynamic fracture toughness behaviour of heavy section steels for nuclear pressure vessels, 7:666
**STEEL-ASTM-A516**
**Fatigue**
Low cycle fatigue behaviour and cumulative damage effect of SA-516-70 steel at room and high temperature, 7:661
**Fracture Properties**
Evaluations of the criterion for lateral expansion of steels for nuclear components, 7:665
**STEEL-ASTM-A533**
**Fracture Properties**
Static and dynamic fracture toughness behaviour of heavy section steels for nuclear pressure vessels, 7:666
**STEEL-ASTM-A533-B**
**Cracks**
Towards the development of mechanistically-based design rules for corrosion fatigue in ductile steels, 7:660
**Fatigue**
Towards the development of mechanistically-based design rules for corrosion fatigue in ductile steels, 7:660
**Fracture Properties**
Evaluations of the criterion for lateral expansion of steels for nuclear components, 7:665
Evidence for the relative importance of dynamic fracture toughness, 7:690
Fracture toughness and crack growth resistance of submerged arc and manual metal arc weldments in A533B plate, 7:667
Fracture toughness of heavy section LWR pressure vessel steel plate produced by basic oxygen furnace and ladle refining process, 7:668
Improvement of properties in heavy section nuclear reactor steel plates, 7:669
**STEELS**
*See also AUSTENITIC STEELS*
*CARBON STEELS*
*FERRITIC STEELS*
*STAINLESS STEELS*
*STEEL-ASTM-A508*

*STEEL-ASTM-A516*
*STEEL-ASTM-A533*
**Corrosion**
Carbon deposition on iron and steel surfaces, 7:659
**Creep**
Equipment for long-term testing of material creep in liquid sodium, 7:398 (INIS-mf—6423)
**Fatigue**
Criterion for analysing fatigue crack initiation in geometrical singularities, 7:691
**Fracture Properties**
2- and 3-dimensional elasto-plastic finite element analysis of an SENB fracture specimen, 7:461
Applicability of JIS SPV 50 steel to primary containment vessels of nuclear power stations, 7:670
Evaluations of the criterion for lateral expansion of steels for nuclear components, 7:665
**Materials Testing**
Approaches to experimental testing of steel properties in liquid sodium, 7:651 (INIS-mf—6423)
**Physical Radiation Effects**
Radiation damage saturation in reactor pressure vessel steel. Data and preliminary model, 7:456
Radiation damage in some EN steels, 7:700
Status of radiation embrittlement trend curve data base re-evaluation, 7:292 (EUR—6813(Vol.1))

**STELLAR ATMOSPHERES**
**Alfven Waves**
Reflexion and transmission of Alfven waves in an atmosphere, 7:1305
**Infrared Spectra**
Atmospheric structure of the low-temperature stars, 7:1370
**Wave Propagation**
Reflexion and transmission of Alfven waves in an atmosphere, 7:1305

**STOMACH**
**Delayed Radiation Effects**
Immediate and delayed radiation reaction of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1216
State of motor function of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1240
**Early Radiation Effects**
Immediate and delayed radiation reaction of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1216

**STORAGE FACILITIES**
*See also NATURAL GAS*
*PETROLEUM*
**Temperature Effects**
Parametric study of the temperature differential across the wall of an underground storage vault for monitored storage of radioactive wastes, 7:225

**STORAGE (SPENT FUEL)**
*See SPENT FUEL STORAGE*

**STORAGE TUBES**
*See ELECTRON TUBES*

**STRAND BREAKS**
**Radioprotective Substances**
Chemical protection against x-ray damage to animal cells in vitro, 7:1246 (INIS-mf—6531)

**STRESS ANALYSIS**
**Finite Element Method**
Finite element structural analysis of coil and casing of a large superconducting toroidal LCT-magnet, 7:1690
**Mathematical Models**
Order, heat, intrinsic dissipation and inelastic analysis, 7:1663
**Superconducting Magnets**
Finite element structural analysis of coil and casing of a large superconducting toroidal LCT-magnet, 7:1690

**STRIPPING**
*(Nuclear reactions in which one or more nucleons is stripped from the incident particle.)*
**Algorithms**
Program for computation of cross section and analyzing power of deuteron stripping in the analog channel threshold by the distorted wave method, 7:1618 (KFTI—79-40)

**STRONG INTERACTIONS**
*See also HADRON-HADRON INTERACTIONS*
**Total Cross Sections**
Why rising cross-sections are further evidence for a non-Abelian gauge theory of strong interactions, 7:1521
**Yang-Mills Theory**
Why rising cross-sections are further evidence for a non-Abelian gauge theory of strong interactions, 7:1521

**STRONTIUM**
**Precipitation**
Precipitation of radiostrontium in soil, 7:1008

**STRONTIUM 85**
**Leaching**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209

**STRONTIUM 90**
**Buildup**
Main regularities of $^{90}Sr$ migration in mother-fetus biological system. Chapter 5.2, 7:1181
**RBE**
RBE of $\alpha$-particles versus $\beta$-particles in bone sarcoma induction, 7:1185
**Scintillation Counting**
Relatively fast assay of Sr-90 by measuring the Cherenkov effect from the ingrowing Y-90, 7:774
**Synergism**
Neoplasm appearance resulting from chronic intake of mixtures of radium-226, strontium 90, ddt, 7:1233

**STRONTIUM CHLORIDES**
**Solubility**
$SrCl_2$ solubility in complex brines, 7:814

**STRONTIUM COMPOUNDS**
**Entropy**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**Specific Heat**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849

**STRONTIUM IONS**
**Metastable States**
Peculiarities of electric discharges in mixtures of metal vapors and rare gases at increased pressures, 7:895

**STRUCTURAL BEAMS**
**Deformation**
Structural beam shapes under cyclic inelastic loads, 7:469

**STRUCTURES (MECHANICS)**
*See MECHANICAL STRUCTURES*

**SUBSTRATES**
**Evaluation**
Colonization of artificial substrates by protozoa: replicated samples, 7:1114

**SUDAN**
**Agriculture**
Effect of desertification and soil salinity on land productivity in the Sudan, 7:1127 (IAEA-TECDOC—236)
**Soil Conservation**
Review of soil conservation in the Sudan (1940-1979), 7:1132 (IAEA-TECDOC—236)

**SULFUR**
**Corrosive Effects**
Sulphur ingress into Hinkley Point 'B' AGR and its effect on carbon monoxide oxidation, 7:368
**Ecological Concentration**
Sulfur gas emissions from stored flue gas desulfurization sludges, 7:1005
**Monitoring**
Sulphur ingress into Hinkley Point 'B' AGR and its effect on carbon monoxide oxidation, 7:368

**SULFUR 35**
**Metabolism**
Radioactive sulphur metabolism in rat organism in the early stages of dental caries, 7:1232

**SULFUR DIOXIDE**
**Atmospheric Chemistry**
Impact study of a primary sulfate emission source, 7:985
**Ecological Concentration**
Impact study of a primary sulfate emission source, 7:985

**Removal**
Removal of SOx and NOx from flue gases by electron radiation, 7:984
**SULFUR FLUORIDES**
**Air Pollution**
Atmospheric dispersion study with $^{85}Kr$ and $SF_6$ gas, 7:993
**SULFUR ISOTOPES**
**Mass Spectroscopy**
New automated mass spectrometer for high precision isotope ratio determinations of gases, 7:785
**SUN**
*See also SOLAR ATMOSPHERE*
**Interplanetary Magnetic Fields**
Interplanetary response to solar long time-scale phenomena, 7:1303
**Magnetic Fields**
Dynamics of large-scale magnetic field evolution during solar cycle 20, 7:1291
Evolution of coronal and interplanetary magnetic fields, 7:1288
Location of compact microwave sources with respect to concentrations of magnetic field in active solar regions, 7:1293
Search for giant cells in the solar convection zone, 7:1290
Solar polar field reversals and secular variation of cosmic ray intensity, 7:1301
Two-level solar dynamo based on solar activity, convection, and differential rotation, 7:1292
**Microwave Radiation**
Solar radar observations, 7:1306
**Research Programs**
Program for the observations of the Sun and heliosphere from space 1980-1995, 7:1364
**SUPER PHENIX REACTOR**
**Spent Fuel Casks**
Special spent fuel assemblies packaging method for the Creys-Malville power plant, 7:406 (INIS-mf—6447)
**Spent Fuel Elements**
Special spent fuel assemblies packaging method for the Creys-Malville power plant, 7:406 (INIS-mf—6447)
**Steam Generators**
Control and operation of the SUPER PHENIX steam generators, 7:425
Prediction of dynamic stability limits of the 45MW scale model of SUPER PHENIX steam generator, 7:421
**SUPERCONDUCTING JUNCTIONS**
**Electrical Properties**
Hotspot induced anomalies and hysteresis in long superconducting Ag-Sn proximity-effect bridges, 7:1656
Phonon-injection-induced nonequilibrium phenomena in superconducting proximity-effect bridges, 7:1657
**Hysteresis**
Hotspot induced anomalies and hysteresis in long superconducting Ag-Sn proximity-effect bridges, 7:1656
**Proximity Effect**
Hotspot induced anomalies and hysteresis in long superconducting Ag-Sn proximity-effect bridges, 7:1656
Phonon-injection-induced nonequilibrium phenomena in superconducting proximity-effect bridges, 7:1657
**SUPERCONDUCTING MAGNETS**
**Fabrication**
Design and fabrication of a high homogeneity high field superconducting magnet, a metal cryostat and a high stability energiser, 7:1660
**Mechanical Properties**
Mechanical anisotropy in superconducting toroidal coil windings, 7:1691
**Performance**
Characteristics of superconducting solenoid with detachable current leads, 7:1659
Design and fabrication of a high homogeneity high field superconducting magnet, a metal cryostat and a high stability energiser, 7:1660
**Stress Analysis**
Finite element structural analysis of coil and casing of a large superconducting toroidal LCT-magnet, 7:1690
**SUPERHEAVY ELEMENTS**
*See TRANS 104 ELEMENTS*
**SUPEROXIDE RADICALS**
**Bibliographies**
Bibliographies on radiation chemistry. 3. Formation and reactivity of the superoxide radical anion, 7:838
**SURFACE AIR**
*See also EARTH ATMOSPHERE*
**Turbulence**
Structure of flow and turbulence in the stable atmospheric surface layer, 7:979 (IA—1356)
**SURFACE BARRIER DETECTORS**
**Beta Dosimetry**
Beta dosimetry with surface barrier detectors, 7:958
**Sensitivity**
Beta dosimetry with surface barrier detectors, 7:958
**SURFACE MINING**
*See also COAL MINING*
**Environmental Impacts**
Air-quality impacts from Western Surface-coal-mining operations, 7:999
**Slope Stability**
Design of a large field shear box, 7:10
**SURFACE WATERS**
*See also COASTAL WATERS*
*LAKES*
*RIVERS*
**Hydrology**
Relations between surface and ground water studied by tritium analyses, 7:1033 (INIS-mf—6422)
**Radioactivity**
RA-226 collective dosimetry for surface waters in the uranium mining region of Pocos de Caldas (Doses to body organs of population), 7:1190
**SURFACES**
*See also SPECTRALLY SELECTIVE SURFACES*
**Chemical Analysis**
Surface analysis: its uses and abuses in waste form evaluation, 7:716
**SUSPENSIONS**
**Density**
Radiometric determination of bulk density of suspensions by the absorption method, 7:972 (INIS-mf—6422)
**SWEDEN**
**Nuclear Power**
Swedish nuclear referendum 1980, 7:615
**SYDSVENSKA KRAFT AB REACTOR 1**
*See BARSEBAECK-1 REACTOR*
**SYENITES**
**Geochemistry**
Geochemical investigations in the Mt. Bundey area, Northern Territory, 7:1272
**SYNROC**
*See SYNTHETIC ROCKS*
**SYNROC PROCESS**
Recent progress on SYNROC development, 7:205
**SYNTHETIC ROCKS**
**Calcination**
Calcination studies on perovskite, zirconolite, barium hollandite and SYNROC-B, 7:675
**Chemical Radiation Effects**
Recent progress on SYNROC development, 7:205
**Comparative Evaluations**
Preliminary evaluation of alternative forms for immobilization of Hanford high-level wastes, 7:199
**Fabrication**
SYNROC research and development at Lucas Heights, 7:708
**Leaching**
Recent progress on SYNROC development, 7:205
SYNROC research and development at Lucas Heights, 7:708
**Physical Radiation Effects**
Isotopic and crystallographic studies of alpha irradiated SYNROC minerals, 7:728
**Synthesis**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**SYRIAN HAMSTER**
*See HAMSTERS*

# T


**T3 HORMONE**
*See TRIIODOTHYRONINE*
**T4 HORMONE**
*See THYROXINE*
**TANDEM ACCELERATORS**
*See VAN DE GRAAFF ACCELERATORS*
**TANDEM ELECTROSTATIC ACCELERATORS**
**Radiation Monitors**
Microprocessor based area monitor system for neutron and gamma radiation, 7:921
**TANTALUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Multi-Element Analysis**
Analysis of gamma-ray spectra. Chapter 3. Section 1, 7:748
**Oxidation**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**TANTALUM 181 TARGET**
**Alpha Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**Argon 40 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Carbon 12 Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**Deuteron Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**Neon 20 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Neon 22 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Proton Reactions**
Nucleus-nucleus collisions at 4.2 GeV/c per nucleon momentum, 7:1492
**TAPIRO REACTOR**
**Benchmarks**
Propagation experiments in steel-sodium media at TAPIRO, 7:544
**Neutron Transport**
Propagation experiments in steel-sodium media at TAPIRO, 7:544
**Shielding**
Propagation experiments in steel-sodium media at TAPIRO, 7:544
**TARAPUR-1 REACTOR**
**Burnable Poisons**
Fabrication of burnable poison fuel pellets for TAPS - plant experience, 7:287
**Fuel Elements**
Fabrication of burnable poison fuel pellets for TAPS - plant experience, 7:287
Pellet-clad interaction observations in boiling water reactor fuel elements, 7:277 (IWGFPT—8)
**TARAPUR-2 REACTOR**
**Burnable Poisons**
Fabrication of burnable poison fuel pellets for TAPS - plant experience, 7:287
**Fuel Elements**
Fabrication of burnable poison fuel pellets for TAPS - plant experience, 7:287
Pellet-clad interaction observations in boiling water reactor fuel elements, 7:277 (IWGFPT—8)
**TARGETS**
*See also ALUMINIUM 27 TARGET*
*BERYLLIUM 9 TARGET*
*BORON 10 TARGET*
*BORON 11 TARGET*
*CALCIUM 40 TARGET*
*CALCIUM 48 TARGET*
*CARBON 12 TARGET*
*CERIUM 140 TARGET*
*COPPER 63 TARGET*
*CURIUM 248 TARGET*
*DEUTERIUM TARGET*
*GERMANIUM 72 TARGET*
*GERMANIUM 74 TARGET*
*GOLD 197 TARGET*
*HELIUM 3 TARGET*
*HELIUM 4 TARGET*
*LITHIUM 6 TARGET*
*LITHIUM 7 TARGET*
*OXYGEN 16 TARGET*
*PLUTONIUM 242 TARGET*
*SILICON 28 TARGET*
*TANTALUM 181 TARGET*
*TERBIUM 159 TARGET*
*THORIUM 232 TARGET*
*URANIUM 238 TARGET*
*ZIRCONIUM 90 TARGET*
**Thickness**
Definition of absolute differential cross sections in the case of using many-component targets, 7:1620 (KFTI—79-40)
**TARTARIC ACID ESTERS**
**Chemical Radiation Effects**
Asymmetric crystal seeding in the presence of beta particles. Chapter 16, 7:843
**Crystallization**
Asymmetric crystal seeding in the presence of beta particles. Chapter 16, 7:843
**TECHNETIUM 99**
**Mutagenesis**
Mutagenesis by technetium-99 and by chemicals, 7:1168 (INIS-mf—6531)
**Radionuclide Kinetics**
Quantitative 99mTc-diphosphonate whole body retention, plasma PTH and bone loss in oophorectomized women, 7:1076
**TELLURIUM**
**Corrosive Effects**
Effect of fission product interactions on the corrosion and mechanical properties of HTGR alloys, 7:683
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**TERBIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Multi-Element Analysis**
Analysis of gamma-ray spectra. Chapter 3. Section 1, 7:748
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**TERBIUM 159 TARGET**
**Argon 40 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Neon 20 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Neon 22 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**TERNARY FISSION**
Multi-centre shell model, 7:1631
**TEST FACILITIES**
Design of surface heating of experimental sodium facility at VUHZ Dobra, 7:401 (INIS-mf—6423)
Equipment for long-term testing of material creep in liquid sodium, 7:398 (INIS-mf—6423)
Problems of building sodium test circuit at VUZES, 7:397 (INIS-mf—6423)
Simulating thermodynamic effects in liquid sodium reactor facilities using electrically heated fuel element mock-ups, 7:400 (INIS-mf—6423)

Technological research of components and materials using UJV sodium stand, 7:399 (INIS-mf—6423)
Testing induction pumps on KAS I facility and problems of safety of work in testing plant, 7:403 (INIS-mf—6423)
**Alarm Systems**
System and equipment for securing operation safety of experimental stand, 7:548 (INIS-mf—6423)
**TEST FAST BREEDER REACTOR KALPAKKAM**
*See KALPAKKAM LMFBR REACTOR*
**TESTOSTERONE**
**Radioimmunoassay**
Czechoslovak-made testosterone RIA kit, 7:1063 (INIS-mf—6419)
Iodinated steroid derivatives, 7:1056 (INIS-mf—6419)
RIA properties of iodo-derivatives of methyl testosterone, 7:1057 (INIS-mf—6419)
Testosterone concentration in mother's serum and in amniotic fluid, 7:1112 (INIS-mf—6419)
**TETRAHYMENA**
**Radiosensitivity**
Radiation sensitivity of tetrahymena pyriformis, 7:1152 (INIS-mf—6531)
**TEXAS**
**Solution Mining**
Uranium solution mining: comparison of New Mexico with South Texas, 7:155
**THALLIUM COMPLEXES**
**Enthalpy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**Entropy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**Free Energy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**THE NEXT STEP DEVICE**
*See TNS REACTORS*
**THERMAL ANALYSIS**
**Meetings**
Meeting on calorimetry and thermal analysis, 7:811
**THERMAL DECAY TIME LOG**
*See NEUTRON-GAMMA LOGGING*
**THERMAL ENERGY STORAGE EQUIPMENT**
**Materials**
Solar Materials Science, 7:260
**THERMAL POWER PLANTS**
*See also FOSSIL-FUEL POWER PLANTS*
*GEOTHERMAL POWER PLANTS*
*NUCLEAR POWER PLANTS*
**Control Systems**
Design concepts and experience in the application of distributed computing to the control of large CEGB power plant, 7:274 (AECL—7056)
**THERMAL STORAGE**
*See HEAT STORAGE*
**THERMOCHEMICAL HEAT STORAGE**
**Thermochemical Processes**
Application of reversible chemical reactions to solar thermal energy systems, 7:270
**THERMOCHEMICAL PROCESSES**
**Materials**
Materials science issues encountered during the development of thermochemical concepts, 7:819
**THERMOCOUPLES**
Utilization of thermocouple random signal correlation method for coolant flow rate measuring in nuclear power plants, 7:453
**Calibration**
Use of indexed sensitivity factors in the analysis of nickel and iron based alloys. A study of the decalibration of sheathed Chromel/Alumel thermocouples, 7:975
**THERMOLUMINESCENT DOSEMETERS**
**Gamma Dosimetry**
Gamma-ray energy deposition measurements in a heterogeneous core and their analysis, 7:395 (EUR—6813(Vol.2))
Review of session L: dosimetry techniques, 7:925 (EUR—6813(Vol.2))
**Neutron Dosimetry**
Review of session L: dosimetry techniques, 7:925 (EUR—6813(Vol.2))
**Performance**
Gamma-ray energy deposition measurements in a heterogeneous core and their analysis, 7:395 (EUR—6813(Vol.2))
**THERMONUCLEAR REACTOR MATERIALS**
Structural design methods for ceramics in fusion reactors, 7:1701
**Physical Radiation Effects**
Mechanical properties of materials in fusion reactor first-wall and blanket systems, 7:679
**THERMONUCLEAR REACTORS**
*(For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.)*
*See also E-BEAM TYPE REACTORS*
*JET REACTORS*
*LASER FUSION REACTORS*
*MAGNETIC MIRROR TYPE REACTORS*
*TNS REACTORS*
*TOKAMAK TYPE REACTORS*
Finite element structural analysis of coil and casing of a large superconducting toroidal LCT-magnet, 7:1690
**Breeding Blankets**
Experimental study of gaseous lithium deuterides and lithium oxides. Implications for the use of lithium and $Li_2O$ as breeding materials in fusion reactor blankets, 7:1680
Stress analysis of blanket vessel for JAERI experimental fusion reactor, 7:1699
**Magnet Coils**
Applications of metallic composites in the magnet system of a demonstration fusion reactor, 7:1681
**Mechanical Structures**
Structural analysis of compact experiments for thermonuclear ignition, 7:1694
**Safety**
Fusion reactor safety, 7:1686
**Shock Waves**
Shock and blast load attenuation in inertial confinement fusion reactors, 7:1689
**Superconducting Magnets**
Mechanical anisotropy in superconducting toroidal coil windings, 7:1691
**Wall Loading**
Shock and blast load attenuation in inertial confinement fusion reactors, 7:1689
**THIO COMPOUNDS**
*See ORGANIC SULFUR COMPOUNDS*
**THORIUM**
**Activation Analysis**
$^{230}$Th assay by epithermal neutron activation analysis, 7:776
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
Neutron counting in activation analysis. Chapter 3. Section 3, 7:750
**Geochemistry**
Distribution of U, Th and K through a section of the granitic crust of the Vredefort basement, 7:1274
**Solvent Extraction**
Extraction of Th(IV) and U(VI) by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:745
**Spectrophotometry**
Analysis of uranium and its alloys. Thorium spectrophotometric determination, 7:805 (CEA-CETAMA—7)
**THORIUM 232 TARGET**
**Argon 40 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)

**Neon 20 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**Neon 22 Reactions**
Fast charged-particle emission in heavy-ion reactions, 7:1596 (JINR-D—4-80-385)
**THORIUM CARBIDES**
**Thermodynamic Properties**
Thermodynamic studies of thorium carbide fuel preparation and fuel/clad compatibility, 7:707
**THORIUM COMPLEXES**
**Thermodynamic Properties**
Aqueous actinide complexes. A thermochemical assessment, 7:847
**THORIUM PHOSPHATES**
*See also MONAZITES*
**Phase Studies**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**THREE MILE ISLAND-2 REACTOR**
**Radiation Accidents**
Radiological consequences of the Three Mile Island accident, 7:1187
**THTR-300 REACTOR**
**Containment Buildings**
Impact testing of steel fibre reinforced concrete slabs with liner, 7:376
**Engineered Safety Systems**
Design, construction and pressure test of a PCIV gas storage vessel for the THTR-300, 7:375
**Shielding**
Shielding data requirement for thermal power reactors of boiling water and gas cooled type, 7:286
**THULIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**THYMUS**
**Morphological Changes**
Structural and functional change peculiarities in immunocompetent organs during radiation injury in animals treated with αZ-macroglobulin, 7:1223
**THYMUS CELLS**
**Biological Radiation Effects**
Morphological and biochemical changes in genesis of postradiation interphase cell killing, 7:1210
**THYROID**
**Radiation Protection**
Protective action guides. Theory and application lessons from the Three Mile Island accident, 7:989
**Radioisotope Scanning**
Radioisotopic study on the thyroid after surgical treatment of patients with different form of goiter, 7:1108
**Radionuclide Kinetics**
In vitro studies of the cellular transport of radioactive caesium-134m in rat thyroid tissue, 7:1167 (INIS-mf—6531)
Iodine accumulating activity of thyroid autoplastic graft in the early period after subtotal resection of thyroid, 7:1107
**THYROID HORMONES**
*See also THYROXINE*
*TRIIODOTHYRONINE*
Stimulation of $^{45}Ca$ release from bone by embryonic chick parathyroid glands in vitro, 7:1175
**Dynamic Function Studies**
Differences in response of serum calcium, $^{45}$calcium, and $^{3}$H-tetracycline to parathyroid hormone in normal and calcium-deficient dogs, 7:1080
**THYROID STIMULATING HORMONE**
*See TSH*
**THYROTOXICOSIS**
*See HYPERTHYROIDISM*
**THYROXINE**
**Radioimmunoassay**
Acute effect of haemodialysis on thyroid hormone level, 7:1111 (INIS-mf—6419)
Complex diagnosis of thyroid gland disease by in vitro tests without using expensive commercial kits, 7:1110 (INIS-mf—6419)
Factors affecting qualitative and quantitative $T_4$ determination by RIA. (Experimental $T_4$ RIA kits), 7:1060 (INIS-mf—6419)
Radioisotope diagnosis in vitro in clinical examinations. Chapter 10, 7:1101
**TIBIA**
**Dynamic Function Studies**
Role of bone in calcium ion homeostasis: studies with indicator-dilution methods, 7:1078
**TIMING CIRCUITS**
Constant velocity Moessbauer spectrometer free of long-term instrumental drifts in the count rate, 7:969
**TIN**
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)
**TITANATES**
**Comparative Evaluations**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209
**TITANIUM**
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Spectroscopy**
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
**TITANIUM ALLOYS**
**Corrosion**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**Mechanical Properties**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**TITANIUM OXIDES**
*See also PEROVSKITE*
**Chemical Reactions**
Complex use of thermal analysis methods to study interaction of vanadium and titanium oxides with ammonium phosphates, 7:822
**TNS REACTORS**
**Planning**
USA/TNS programs. Engineering considerations, 7:1682
**TOKAMAK DEVICES**
*See also ALCATOR DEVICE*
**Bundle Divertors**
Experimental results from the DITE bundle divertor, 7:1678
**Magnet Coils**
Method for determining the magnet shape in toroidal arrangements, 7:1692
**TOKAMAK TYPE REACTORS**
*See also INTOR TOKAMAK*
*JET REACTORS*
*TNS REACTORS*
**Breeding Blankets**
Dynamic and static structural analysis of liquid lithium blanket of fusion power plants, 7:1698
Thermal analysis of a high-temperature falling bed fusion reactor blanket, 7:1687
**Mechanical Structures**
Structural engineering problems in FINTOR conceptual designs, 7:1684

**Thermonuclear Ignition**
Considerations on the approach to ignition in large tokamaks, 7:1677
**TOP ACCIDENTS**
*See TRANSIENT OVERPOWER ACCIDENTS*
**TRACK DETECTORS (DIELECTRIC)**
*See DIELECTRIC TRACK DETECTORS*
**TRANS 104 ELEMENTS**
**Heavy Ion Reactions**
Multi-centre shell model, 7:1631
**TRANSFORMATIONS (PHASE)**
*See PHASE TRANSFORMATIONS*
**TRANSIENT OVERPOWER ACCIDENTS**
**Fission Product Release**
Fission gas release during anticipated PWR transients, 7:553 (IWGFPT—7)
**Fuel Element Failure**
Modelling of overpower transients with Gapcon-Thermal-3 code, 7:554 (IWGFPT—8)
**TRANSIENTS**
**Computerized Simulation**
BESBET 2 - a computer code for the simulation of severe transients in LMFBR boilers, 7:423
**TRANSITION ELEMENTS**
**Chemical Reaction Kinetics**
Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide, 7:852
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**Thermodynamic Properties**
Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide, 7:852
**TRANSITIONS (PHASE)**
*See PHASE TRANSFORMATIONS*
**TRANSPLUTONIUM ELEMENTS**
*See also AMERICIUM*
*BERKELIUM*
*CALIFORNIUM*
*CURIUM*
*EINSTEINIUM*
*FERMIUM*
*TRANS 104 ELEMENTS*
**Electrophoresis**
Separation of elements by the electromigration method, 7:790
**Fabrication**
Considerations on a sol-gel type process as a fuel fabrication route for the actinide recycle, 7:163 (EUR—6929)
**TRANSPORT**
*(Limited to the movement of goods and persons.)*
**Regulations**
It's a mad mad world, 7:182 (INIS-mf—6447)
**Safety Standards**
System of insurance and indemnity coverage for public liability associated with nuclear materials in the course of transportation in the United States, 7:181 (INIS-mf—6447)
**TRANSURANIUM ELEMENTS**
*See also PLUTONIUM*
*TRANSPLUTONIUM ELEMENTS*
**Inhalation**
Experimental study of cancers induced in the rat by particles with high LET, 7:1193
**TRANSURANIUM WASTES**
*See ALPHA-BEARING WASTES*
**TRAUMA**
*See INJURIES*
**TRAUMATIC SHOCK**
*See INJURIES*
**TRIIODOTHYRONINE**
**Radioimmunoassay**
Acute effect of haemodialysis on thyroid hormone level, 7:1111 (INIS-mf—6419)
Complex diagnosis of thyroid gland disease by in vitro tests without using expensive commercial kits, 7:1110 (INIS-mf—6419)
Triiodothyronine RIA using endogenous antibody. Clinical experience, 7:1067 (INIS-mf—6419)
**TRIPLET PARTICLES**
*See QUARKS*
**TRITIUM**
**Air Pollution**
Occupational exposures associated with laser heat sealers, 7:991
**Cell Killing**
Cell killing as a function of position of tritiated uridine in the cell, 7:1169 (INIS-mf—6531)
**Environmental Exposure Pathway**
Migration of radionuclides following shallow land burial, 7:231
**Personnel Monitoring**
Occupational exposures associated with laser heat sealers, 7:991
**Scintillation Counting**
Decontamination of tritiated water samples prior to tritium assay, 7:775
**TRITIUM OXIDES**
**Decontamination**
Decontamination of tritiated water samples prior to tritium assay, 7:775
**TRITONS**
**Faddeev Equations**
Λ-nucleon potential and binding energy of the hypertriton, 7:1625 (TRI—79-1)
**TRU WASTES**
*See ALPHA-BEARING WASTES*
**TSH**
*(Thyroid stimulating hormone.)*
**Radioimmunoassay**
Acute effect of haemodialysis on thyroid hormone level, 7:1111 (INIS-mf—6419)
Changes in the level of thyrotropic hormones of hypophysis of radioiodinetherapy of thyrotoxicosis, 7:1103
Complex diagnosis of thyroid gland disease by in vitro tests without using expensive commercial kits, 7:1110 (INIS-mf—6419)
**TUBES (CONDUITS)**
*See PIPES*
**TUMOR CELLS**
**Biological Radiation Effects**
Cell production and loss rates in basal and squamous cell carcinomata, before and after irradiation, 7:1147 (INIS-mf—6531)
Nature of cell composition of spleen in cancer of different localization after radiotherapy, 7:1215
**TUMORS**
*See NEOPLASMS*
**TUNGSTEN**
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Heat Treatments**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Metallurgical Effects**
Corrosion behaviour of Ni-Re, Ni-Re-Mo, Ni-Re-Hf, Ni-Re-W-Hf alloys, 7:686
**Oxidation**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Permeability**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Spectroscopy**
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
**TUNISIA**
**Dams**
Oued Zeroud watershed management and Sidi Saad Dam protection, 7:1131 (IAEA-TECDOC—236)
**Water Reservoirs**
Oued Zeroud watershed management and Sidi Saad Dam protection, 7:1131 (IAEA-TECDOC—236)
**TURBULENT HEATING**
**Kinetic Equations**
Collision dominated electron distribution function with turbulent heating in the $H_2$ plasma, 7:1466

**TURNOVER (RADIONUCLIDES)**
*See RADIONUCLIDE KINETICS*
**TWO-PHASE FLOW**
**Numerical Solution**
Power series solutions of the thermal-hydraulic conservation equations, 7:902
**Turbulence**
Turbulence in two-phase flows, 7:904
**TZM**
*See ALLOY-TZM*

## U

**UAR**
*See EGYPTIAN ARAB REPUBLIC*
**UCLLL**
*See LAWRENCE LIVERMORE LABORATORY*
**UJM**
*See JET MODEL*
**ULTRASONIC TESTING**
Detection of failed fuel rods in irradiated fuel assemblies, 7:307
**ULTRAVIOLET RADIATION**
**Biological Radiation Effects**
Frameshift mutagenesis by ultraviolet and gamma radiation, 7:1159 (INIS-mf—6531)
**Genetic Radiation Effects**
UV radiation effects on molecular and cellular systems. Chapter 3.1, 7:1179
**Mutagenesis**
Frameshift mutagenesis by ultraviolet and gamma radiation, 7:1159 (INIS-mf—6531)
**Photochemical Reactions**
UV radiation effects on molecular and cellular systems. Chapter 3.1, 7:1179
**Radiosensitivity Effects**
Relation of mucoprotein metabolism with radiosensitivity of rat organism exposed to ultraviolet radiation, 7:1205
**UNCORRELATED-JET MODEL**
*See JET MODEL*
**UNDERGROUND DISPOSAL**
**Radionuclide Migration**
Migration of radionuclides following shallow land burial, 7:231
**UNDERGROUND MINING**
**Rock Bursts**
CSIRO coal research, with emphasis on mining, 7:7
Drainage of methane from the solid at West Cliff Colliery. Part 1. Optimization of drainage hole design parameters, 7:8
Evaluation of the microseismic technique for outburst warning at West Cliff Colliery, 7:5
Use of adsorption/desorption isotherms in predicting outburst conditions (Global data), 7:6
**Strata Control**
Investigation of a bolted coal mine roof during mining at Nattai North Colliery, 7:9
**UNIFIED GAUGE MODELS**
**Mass**
Unified gauge theories and the problem of mass, 7:1550 (IPNO-TH—80-49)
**UNITARY POLE APPROXIMATION**
*(Separable approximation to S-wave off-energy-shell matrix.)*
Unitary pole approximation, 7:1634
**UNITED ARAB REPUBLIC**
*See EGYPTIAN ARAB REPUBLIC*
**UNITED KINGDOM**
**Geology**
Geology of the Cardigan Bay-St. George's Channel Basin, 7:49
Nature of the continental crust beneath Britian, 7:1248
**Occupational Safety**
Flexibility in radiation protection legislation. The UK approach, 7:630
**Oil Fields**
Wytch Farm oil field, Dorset, 7:53
**Petroleum Deposits**
Geology of the Cardigan Bay-St. George's Channel Basin, 7:49
Wytch Farm oil field, Dorset, 7:53
**Tectonics**
Nature of the continental crust beneath Britian, 7:1248
**Water Pollution**
Solute transport in the unsaturated zone of the Chalk, 7:1034
**UNITED KINGDOM ORGANIZATIONS**
**Nuclear Facilities**
Experience with a servo-hydraulic mechanical testing machine installed in a new shielded active facility at Windscale Nuclear Power Development Laboratories, 7:861
**Radiation Protection Laws**
Review from the regulatory position of the control of occupational exposure associated with the first 20 years of the United Kingdom commercial nuclear power programme, 7:631
**UNITED STATES OF AMERICA**
*See USA*
**URANATES**
*See also AMMONIUM URANATES*
*CESIUM URANATES*
**Entropy**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**Specific Heat**
Alkaline earth uranates. An exploration of their thermophysics and stabilities, 7:849
**URANINITES**
Uraninite and its alteration products, Koongarra uranium deposit, 7:81
**URANIUM**
*See also ENRICHED URANIUM*
**Activation Analysis**
$^{230}$Th assay by epithermal neutron activation analysis, 7:776
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
Neutron counting in activation analysis. Chapter 3. Section 3, 7:750
**Availability**
Long term uranium supply outlook, 7:184
**Chemical Analysis**
Analysis of uranium and some uranium alloys. Aluminium spectrophotometric determination, 7:793 (CEA-CETAMA—7)
Analysis of uranium and some of its compounds and alloys. Silicon spectrophotometric determination, 7:794 (CEA-CETAMA—7)
Analysis of uranium and some of its compounds or alloys. Silicon trace spectrophotometric determination, 7:795 (CEA-CETAMA—7)
Analysis of uranium and of some of its compounds and alloys. Copper spectrophotometric determination, 7:798 (CEA-CETAMA—7)
Analysis of uranium and its alloys. Thorium spectrophotometric determination, 7:805 (CEA-CETAMA—7)
**Distribution Functions**
Role of clay adsorption in genesis of uranium ores, 7:83
**Fluorescence Spectroscopy**
Analysis of plutonium and its compounds. Uranium determination by fluorimetry, 7:797 (CEA-CETAMA—7)
**Geochemistry**
Distribution of U, Th and K through a section of the granitic crust of the Vredefort basement, 7:1274
**Ion-Atom Collisions**
Positron production in heavy ion collisions, 7:1411
**Isotope Dating**
Internal isochrone method in accessory zircon dating, 7:1271
**Mineralization**
Bernabe Montano uranium deposit, Sandoval County, 7:120
Deposition and early hydrologic evolution of Westwater Canyon wet alluvial-fan system, 7:102
Exploration for uranium deposits, Grants mineral belt, 7:137
Geology and recognition of a relict uranium deposit in Sec. 28, T. 14 N., R. 10 W., Southwest Ambrosia Lake Area, McKinley County, 7:116
Geology and characteristics of uranium mineralzation in Morrison Formation at Dennison-Bunn Claim, Sandoval County, 7:122

Jackpile-Paguate deposit: a review, 7:144
Sedimentary controls on uranium ore at L-Bar deposits, Laguna District, New Mexico, 7:146
**Phase Diagrams**
Phase equilibria in the uranium-chromium-carbon system, 7:671
**Production**
Impact of new technology on the economics of uranium production from low-grade ores, 7:156
**Recovery**
Potential by-product uranium production in the United States of America, 7:157
**Redox Reactions**
Structural and redox properties of uranium in Ca-Mg-Al-silicate glasses, 7:201
**Solvent Extraction**
Extraction of Th(IV) and U(VI) by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:745
**Spectrophotometry**
Analysis of uranium-containing solutions. Uranium VI spectrophotometric determination, 7:804 (CEA-CETAMA—7)
**Tetragonal Lattices**
Phase equilibria in the uranium-chromium-carbon system, 7:671
**URANIUM 234**
**Isotope Ratio**
$^{234}U/^{238}U$ activity ratios in clay as a function of distance from primary ore, 7:132
**URANIUM 235**
**Isomeric Transitions**
Conversion electron spectrum of the $(1/2)^+$ isomer of $^{235}U$, 7:1600 (INDC(CCP)—135/LN)
Half-life of the $(1/2)^+$ -isomer of $^{235}U$, 7:1599 (INDC(CCP)—135/LN)
**URANIUM 238**
**Isotope Ratio**
$^{234}U/^{238}U$ activity ratios in clay as a function of distance from primary ore, 7:132
**URANIUM 238 REACTIONS**
**Deep Inelastic Heavy Ion Reactions**
Fission properties of very heavy nuclei produced in deep-inelastic collisions, 7:1603
**Fission**
Fission properties of very heavy nuclei produced in deep-inelastic collisions, 7:1603
**URANIUM 238 TARGET**
**Uranium 238 Reactions**
Fission properties of very heavy nuclei produced in deep-inelastic collisions, 7:1603
**URANIUM ALLOYS**
*See also URANIUM BASE ALLOYS*
**Chemical Analysis**
Analysis of uranium and its alloys. Thorium spectrophotometric determination, 7:805 (CEA-CETAMA—7)
**URANIUM BASE ALLOYS**
**Chemical Analysis**
Analysis of uranium and some uranium alloys. Aluminium spectrophotometric determination, 7:793 (CEA-CETAMA—7)
Analysis of uranium and some of its compounds and alloys. Silicon spectrophotometric determination, 7:794 (CEA-CETAMA—7)
Analysis of uranium and some of its compounds or alloys. Silicon trace spectrophotometric determination, 7:795 (CEA-CETAMA—7)
Analysis of uranium and of some of its compounds and alloys. Copper spectrophotometric determination, 7:798 (CEA-CETAMA—7)
**URANIUM CARBIDES**
**Chemical Reaction Kinetics**
Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide, 7:852
**Cold Pressing**
Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors, 7:419
**Thermodynamic Properties**
Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide, 7:852
**URANIUM COMPOUNDS**
**Chemical Analysis**
Analysis of uranium-containing solutions. Uranium VI spectrophotometric determination, 7:804 (CEA-CETAMA—7)
**URANIUM DEPOSITS**
*See also JABILUKA DEPOSIT*
*KOONGARRA DEPOSIT*
*NABARLEK DEPOSIT*
*RANGER DEPOSIT*
**Exploration**
$^{234}U/^{238}U$ activity ratios in clay as a function of distance from primary ore, 7:132
Anomalous orebody within the Ambrosia Lake trend at Sandstone Mine, 7:142
Applications of computer modeling to the genesis, exploration, and in-situ mining or uranium and vanadium deposits (Code WATEQF), 7:148
Bernabe Montano uranium deposit, Sandoval County, 7:120
Comparison of exploration techniques in Saskatchewan and the Northern Territory, 7:135
Comparison of braided-stream depositional environment and uranium deposits at Saint Anthony underground mine, 7:121
Depositional environments as ore controls in salt wash member, Morrison Formation (Upper Jurassic), Carrizo Mountains area, Arizona and New Mexico, 7:107
Depositional environment of Brushy Basin Member, Morrison Formation, in Gulf Mariano Lake mine, McKinley County, 7:111
Disconformities in Grants mineral belt and their relationship to uranium deposits, 7:139
Estimation of the uranium potential of Finnish bedrock, 7:128
Evaluation of uranium resources in Antarctica, 7:127
Experience with the track etch method for uranium exploration in Northern Australia, 7:131
Exploration in Grants uranium region since 1963, 7:136
Exploration for uranium deposits, Grants mineral belt, 7:137
Genetic models and their impact on uranium exploration in the Athabasca sandstone basin, Saskatchewan, Canada, 7:133
Geology and exploration of the Rum Jungle Uranium Field, 7:71
Geology and mineral technology of the grants uranium region 1979, 7:59 (CONF-7905120—)
Geology and ore deposits of Johnny M mine, Ambrosia Lake District, 7:118
Geology and development of Marquez, New Mexico, uranium deposit, 7:143
Geology and characteristics of uranium mineralzation in Morrison Formation at Dennison-Bunn Claim, Sandoval County, 7:122
Geology of pre-Dakota uranium geochemical cell, sec. 13, T. 16 N., R. 17 W., Church Rock area, McKinley County, 7:108
Geology of Crownpoint Sec. 29 uranium deposit, McKinley County, 7:109
Geology of eastern Smith Lake ore trend, Grants mineral belt, 7:110
Heavy-mineral criteria for subsurface uranium exploration, San Juan Basin, New Mexico, 7:114
History of the evaluation and exploitation of a group of small uranium mines in Portugal, 7:125
Jackpile-Paguate deposit: a review, 7:144
Magnitude and variability of disequilibrium in San Antonio Valley uranium deposit, Valencia County, 7:145
Mineralogical variations across Mariano Lake roll-type uranium deposits, McKinley County, 7:112
Mineralogy and geochemistry of Mariano Lake uranium deposit, Smith Lake district, 7:113
Organic geochemistry and uranium in Grants mineral belt, 7:103
Origin and significance of organic matter in uranium deposits of Morrison Formation, San Juan Basin, New Mexico, 7:104
Present exploration status of the Lianshanguan uranium deposit, Northeast China, 7:134

Radon emanation over an orebody: search for long-distance transport of radon, 7:150
Redistributed orebodies of Poison Canyon, Sec. 18 and 19, T. 13 N., R. 9 W., McKinley County, 7:117
Research on interactive genetic-geological models to evaluate favourability for undiscovered uranium resources, 7:130
Scanning-electron-microscope investigation of paragenesis of uranium deposits, Mount Taylor and elsewhere, Grants Mineral Belt, 7:119
Sedimentary controls on uranium ore at L-Bar deposits, Laguna District, New Mexico, 7:146
Tertiary oxidation in Westwater Canyon member of Morrison formation, 7:1262
Uranium in Niger, 7:63
Uranium in Todilto Limestone (Jurassic) of New Mexico: example of a Sabkha-Like Deposit, 7:147
Uranium ore rolls in Westwater Canyon sandstone, San Juan Basin, New Mexico, 7:141
Uranium potential of Greenland - A geological analysis of favourability, 7:129
Use of helium in uranium exploration, Grants district, 7:149

**Geochemistry**
Fluid inclusion and oxygen isotope studies of the Nabarlek and Jabiluka uranium deposits, Northern Territory, Australia, 7:76
Mineralogy and geochemistry of Mariano Lake uranium deposit, Smith Lake district, 7:113

**Geologic History**
Geochronologic studies in the Grants mineral belt, 7:138
Geology of pre-Dakota uranium geochemical cell, sec. 13, T. 16 N., R. 17 W., Church Rock area, McKinley County, 7:108

**Geology**
Depositional environments as ore controls in salt wash member, Morrison Formation (Upper Jurassic), Carrizo Mountains area, Arizona and New Mexico, 7:107
Disconformities in Grants mineral belt and their relationship to uranium deposits, 7:139
Geologic setting of the East Alligator uranium deposits and prospects, 7:69
Geology and exploration of the Rum Jungle Uranium Field, 7:71
Geology and mineral technology of the grants uranium region 1979, 7:59 (CONF-7905120—)
Geology and recognition of a relict uranium deposit in Sec. 28, T. 14 N., R. 10 W., Southwest Ambrosia Lake Area, McKinley County, 7:116
Geology and ore deposits of Johnny M mine, Ambrosia Lake District, 7:118
Geology and development of Marquez, New Mexico, uranium deposit, 7:143
Geology and characteristics of uranium mineralzation in Morrison Formation at Dennison-Bunn Claim, Sandoval County, 7:122
Geology of the Alligator Rivers Uranium Field, 7:68
Geology of uranium vein deposits (including Schwartzwalder Mine) in Proterozoic metamorphic rocks, Front Range, Colorado, 7:93
Geology of Crownpoint Sec. 29 uranium deposit, McKinley County, 7:109
International Uranium Geology Information System, 7:65
Key Lake U-Ni deposits. A model for Lower Proterozoic uranium deposition, 7:89
Origin and significance of organic matter in uranium deposits of Morrison Formation, San Juan Basin, New Mexico, 7:104
Symposium. Retrospect and discussion, 7:98
Tertiary oxidation in Westwater Canyon member of Morrison formation, 7:1262
Uranium geology in the Amer-Dubawnt-Yathkyed-Baker Lakes region, Keewatin District, N.W.T. Canada, 7:88

**Global Aspects**
Grants and world uranium, 7:100
Uranium deposits of the future, 7:97

**Information Systems**
International Uranium Geology Information System, 7:65

**Meetings**
Geology and mineral technology of the grants uranium region 1979, 7:59 (CONF-7905120—)

**Organic Matter**
Origin and significance of organic matter in uranium deposits of Morrison Formation, San Juan Basin, New Mexico, 7:104

**Origin**
Continental weathering and development of palaeosurface-related uranium deposits. Some genetic considerations, 7:96
Effects of ground-water flow on the origin of Colorado Plateau-type uranium deposits, 7:105
Uranium in Todilto Limestone (Jurassic) of New Mexico: example of a Sabkha-Like Deposit, 7:147

**Petrogenesis**
Evaporites and uranium mineralization in the Pine Creek Geosyncline, 7:84

**Petrology**
Petrology of Westwater Canyon member, Morrison Formation, East Chaco Canyon drilling project, New Mexico-comparison with Grants mineral belt, 7:115

**Prospecting**
Petrology of Westwater Canyon member, Morrison Formation, East Chaco Canyon drilling project, New Mexico-comparison with Grants mineral belt, 7:115

**Quantitative Chemical Analysis**
Jackpile-Paguate deposit: a review, 7:144

**Radionuclide Migration**
Alkali and alkaline earth element studies at Oklo, 7:60

**Resource Assessment**
Speculative uranium resources: their location and magnitude, 7:64

**Spatial Distribution**
Uranium resources, supply and demand, 7:61

**Stratigraphy**
Bernabe Montano uranium deposit, Sandoval County, 7:120
Comparison of braided-stream depositional environment and uranium deposits at Saint Anthony underground mine, 7:121
Depositional environment of Brushy Basin Member, Morrison Formation, in Gulf Mariano Lake mine, McKinley County, 7:111
Geology of eastern Smith Lake ore trend, Grants mineral belt, 7:110
Jackpile-Paguate deposit: a review, 7:144
Stratigraphic implications of uranium deposits, 7:101
Uranium in Todilto Limestone (Jurassic) of New Mexico: example of a Sabkha-Like Deposit, 7:147
Uranium ore rolls in Westwater Canyon sandstone, San Juan Basin, New Mexico, 7:141

**Weathering**
Continental weathering and development of palaeosurface-related uranium deposits. Some genetic considerations, 7:96

**URANIUM DIOXIDE**

**Fabrication**
Characterisation of sintered $UO_2$ pellets relevant to fuel design and performance, 7:381
Effect of precompaction on sintered $UO_2$ pellets, 7:519

**Physical Radiation Effects**
In-reactor densification and relocation of $UO_2$ pellet fuel: preliminary results from the Springfields programme, 7:484 (IWGFPT—7)
Steady state behaviour of gaseous fission products in $UO_2$ nuclear fuel at low temperature, 7:520
Unconstrained swelling of $UO_2$, 7:703 (IWGFPT—7)

**Production**
Aspects of large scale production of $UO_2$ pellets, 7:518

**URANIUM HEXAFLUORIDE**

**Chemical Analysis**
Uranium hexafluoride analysis. Inorganic impurities spectrographic determination, 7:809 (CEA-CETAMA—7)

**Road Transport**
Risk assessment for the transportation of $PuO_2$, $UF_6$ and spent fuel on roads in the Federal Republic of Germany, 7:176 (INIS-mf—6447)

**Transport**
Rescue container to accommodate defective transport containers filled with uranium hexafluoride, 7:859 (INIS-mf—6447)

**URANIUM IONS**
**Ion-Atom Collisions**
Positron production in heavy ion collisions, 7:1411
**URANIUM ISOTOPES**
**Alpha Spectroscopy**
Comparison of mass-spectrometry and α-counting in analysis of uranium and plutonium isotopes in environmental samples, 7:767
**Gamma Spectroscopy**
Analysis of uranium isotopic abundances by fine gamma spectrometry, 7:770
**Isotope Separation**
Plasma centrifuge I: Uranium partial pressure distributions, 7:161
Plasma centrifuge III: Measurements on rotating uranium plasmas, 7:162
**Mass Spectroscopy**
Comparison of mass-spectrometry and α-counting in analysis of uranium and plutonium isotopes in environmental samples, 7:767
**URANIUM MINES**
Mining of the uraniferous shales of Saelices el Chico (Salamanca), 7:152
**Environmental Effects**
Effects of uranium mining of ground water in Ambrosia Lake area, New Mexico, 7:233
Preliminary estimates of effects of uranium-mine dewatering on water levels, San Juan Basin, 7:234
**Environmental Impacts**
Uranium mining development in the Northern Territory: an overview of the issues, 7:229
**Radiation Hazards**
Hazards to the health of uranium workers and the regional population, 7:239
**Radioecology**
Radioecology of uranium and radium with special reference to a uranium mining area, 7:1006 (IAEA-TECDOC—229)
**Social Impact**
Uranium mining development in the Northern Territory: an overview of the issues, 7:229
**Socio-Economic Factors**
Roessing, a case history of economic and social benefits from uranium mining, 7:618
**Water Pollution**
Mining and the natural environment: water and the dispersion of pollutants, 7:230
**URANIUM NITRIDES**
**Cold Pressing**
Powder metallurgy in the fabrication of (UPu)C, (UPu)N and (UPu)(CN) fuels for fast breeder reactors, 7:419
**URANIUM ORES**
Lead isotope studies at Jabiluka, 7:80
**Chemical Analysis**
Organic geochemistry and uranium in Grants mineral belt, 7:103
**Chemical Composition**
Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
**Economics**
Energy analysis applied to uranium resource estimation, 7:62
**Energy Analysis**
Energy analysis applied to uranium resource estimation, 7:62
**Geochemistry**
Mercury distribution in the Jabiluka Two orebody and its host rocks, 7:1273
Movements of uranium and daughter isotopes in the Koongarra uranium deposit, 7:82
Petrology and geochemistry of alteration associated with uranium mineralization at Jabiluka, Northern Territory, Australia, 7:79
Pine Creek Geosyncline. Statistical treatment of whole rock chemical data, 7:67
Rare earth elements in sedimentary rocks, granites and uranium deposits of the Pine Creek Geosyncline, 7:66
**Isotope Ratio**
Contribution to some Saskatchewan uranium deposits mainly from fluid inclusion and isotopic data, 7:90
**Leaching**
Application of the VAW tube digester for metallurgical pressure-leaching processes, 7:159
**Mineralization**
Athabasca basin unconformity-type uranium deposits. A special class of sandstone-type deposits, 7:87
Evaporites and uranium mineralization in the Pine Creek Geosyncline, 7:84
Geochronology and evolution of the late-Archaean basement and Proterozoic rocks in the Alligator Rivers Uranium Field, Northern Territory, Australia, 7:1252
Geology and mineralisation of the South Alligator Valley Uranium Field, 7:70
Geology and exploration of the Rum Jungle Uranium Field, 7:71
Granite ages in the Pine Creek Geosyncline, 7:1253
Model for the development of economic uranium mineralization in the Alligator Rivers Uranium Field, 7:86
Origin of uranium mineralization at Jabiluka, 7:85
Overview of metallic mineralization in the Pine Creek Geosyncline, 7:1257
Stable isotope study of three deposits in the Alligator Rivers Uranium Field, N.T., 7:77
Stratigraphy of the Kapalga Formation north of Pine Creek and its relationship to base metal mineralization, 7:72
Study of the Pine Creek Geosyncline using integrated Landsat and Aeromagnetic data, 7:1256
Symposium. Retrospect and discussion, 7:98
Uraninite and its alteration products, Koongarra uranium deposit, 7:81
**Mineralogy**
Anomalous orebody within the Ambrosia Lake trend at Sandstone Mine, 7:142
Dissolution and authigenesis of feldspars, 7:106
Geology of eastern Smith Lake ore trend, Grants mineral belt, 7:110
Heavy-mineral criteria for subsurface uranium exploration, San Juan Basin, New Mexico, 7:114
Mineralogical variations across Mariano Lake roll-type uranium deposits, McKinley County, 7:112
Mineralogy of the Jabiluka, Ranger, Koongarra and Nabarlek uranium deposits, 7:75
Mineralogy and geochemistry of Mariano Lake uranium deposit, Smith Lake district, 7:113
Nature and significance of the occurrence of uranium in the Nanambu Complex of the Pine Creek Geosyncline, 7:74
Scanning-electron-microscope investigation of paragenesis of uranium deposits, Mount Taylor and elsewhere, Grants Mineral Belt, 7:119
**Mining**
Exploitation study of the ore-body "Tigre III". Open-cut design and study of high-recovery underground mining method for the Tigre III ore-body, 7:153
Grants and world uranium, 7:100
**Morphology**
Origin and significance of organic matter in uranium deposits of Morrison Formation, San Juan Basin, New Mexico, 7:104
**Ore Enrichment**
Impact of new technology on the economics of uranium production from low-grade ores, 7:156
**Petrogenesis**
Association of uranium and skarn development in the Mary Kathleen area, Queensland, 7:94
Role of clay adsorption in genesis of uranium ores, 7:83
**Petrology**
Depositional environment of Brushy Basin Member, Morrison Formation, in Gulf Mariano Lake mine, McKinley County, 7:111
Petrology and geochemistry of alteration associated with uranium mineralization at Jabiluka, Northern Territory, Australia, 7:79
**Radiometric Analysis**
High-precision automated beta/gamma technique for uranium ore analysis, 7:773
**Resources**
Long term uranium supply outlook, 7:184

**Solution Mining**
Applications of computer modeling to the genesis, exploration, and in-situ mining or uranium and vanadium deposits, 7:148
Uranium solution mining: comparison of New Mexico with South Texas, 7:155

**URANIUM OXIDES**
*See also URANIUM DIOXIDE*
**Chemical Analysis**
Analysis of uranium and some of its compounds and alloys. Silicon spectrophotometric determination, 7:794 (CEA-CETAMA—7)
Analysis of uranium and some of its compounds or alloys. Silicon trace spectrophotometric determination, 7:795 (CEA-CETAMA—7)
Analysis of uranium and of some of its compounds and alloys. Copper spectrophotometric determination, 7:798 (CEA-CETAMA—7)

**URANIUM PHOSPHATES**
**Phase Studies**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704
**Synthesis**
Crystal chemistry and phase relations in the synthetic minerals of ceramic waste forms. II. Studies of uranium-containing monazites, 7:704

**URANIUM RESERVES**
Grants and world uranium, 7:100
Uranium deposits of the future, 7:97
Uranium resources, supply and demand, 7:61
**Global Aspects**
Speculative uranium resources: their location and magnitude, 7:64

**URANIUM SULFIDES**
**Chemical Reaction Kinetics**
Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide, 7:852
**Thermodynamic Properties**
Thermodynamics and kinetics of interactions of metals with uranium monocarbide, monosulphide and carbosulphide, 7:852

**URANIUM TETRAFLUORIDE**
**Chemical Analysis**
Uranium tetrafluoride analysis. Silicon spectrophotometric determination, 7:810 (CEA-CETAMA—7)

**URANYL COMPLEXES**
**Thermodynamic Properties**
Aqueous actinide complexes. A thermochemical assessment, 7:847

**URBAN AREAS**
**Air Quality**
Impact of residential wood combustion on urban air quality: first ambient measurements, 7:982

**UROGENITAL SYSTEM DISEASES**
**Biomedical Radiography**
Effective renal blod flow and canalicular function of kidneys with obliterating endarteritis, 7:1104
Radioisotopic renography in the evaluation of rehabilitation of children operated on the occasion of hydronephrosis, 7:1105
**Radiotherapy**
State of motor function of stomach in patients with cervix uteri carcinoma in combined radiotherapy, 7:1240

**US DOE**
*See also LAWRENCE LIVERMORE LABORATORY*
*ROCKY FLATS PLANT*
**Radioactive Waste Management**
High-level radioactive waste management: an intergovernmental agreement to cover federal activities within a state, 7:226 (NP—2900750)

**US ERDA**
**Budgets**
Fossil energy research and development in ERDA (Book chapter), 7:633
**Planning**
Fossil energy research and development in ERDA (Book chapter), 7:633

**USA**
*(For national information only. See individual states for specific references.)*
**Radioactive Waste Disposal**
Management of radioactive wastes in the United States of America, 7:221
**Radioactive Waste Management**
Management of radioactive wastes in the United States of America, 7:221
**Weather**
Climate impact assessment: United States, 7:980 (NP—2900749)
**Wind Power Plants**
Wind energy systems act of 1980, 7:273 (GPO—56-735)

**UTILITIES**
*See ELECTRIC UTILITIES*

## V

**VACCINES**
**Radiosterilization**
Prospects of gamma-radiation application in bacteritic vaccine production, 7:1139 (INIS-mf—5673)

**VACUUM PUMPS**
Calculation model and design principles of the demonstration Tokamak-reactor vacuum system, 7:1679

**VALVES**
*See also RELIEF VALVES*
**Hard Facing**
Replacement of hard coating in nuclear values: results of testing of cobalt free valves, 7:457
**Leak Testing**
Replacement of hard coating in nuclear values: results of testing of cobalt free valves, 7:457

**VAN DE GRAAFF ACCELERATORS**
**Accelerator Facilities**
400 kV proton beam facility for the study of silicon semiconductor detector surfaces and of the stopping power of biological materials, 7:906
**Proton Beams**
400 kV proton beam facility for the study of silicon semiconductor detector surfaces and of the stopping power of biological materials, 7:906

**VANADIUM**
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Heat Treatments**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Ion-Atom Collisions**
Contribution of electron transfer to K-shell ionizations by $N^{7+}$-ion bombardment, 7:1415
**Oxidation**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**Spectroscopy**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)

**VANADIUM 49**
**Energy-Level Transitions**
Collective bands of positive parity states in (FP) shell nuclei, 7:1586

**VANADIUM ALLOYS**
**Electron-Phonon Coupling**
Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V, 7:1658
**Transition Temperature**
Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V, 7:1658

**VANADIUM MINERALS**
**Exploration**
Applications of computer modeling to the genesis, exploration, and in-situ mining or uranium and vanadium deposits (Code WATEQF), 7:148
**Solution Mining**
Applications of computer modeling to the genesis, exploration, and in-situ mining or uranium and vanadium deposits (Code WATEQF), 7:148
**VANADIUM OXIDES**
**Chemical Reactions**
Complex use of thermal analysis methods to study interaction of vanadium and titanium oxides with ammonium phosphates, 7:822
**VANADIUM SILICIDES**
**Electron-Phonon Coupling**
Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V, 7:1658
**Transition Temperature**
Electron phonon coupling constant and critical temperature of some A15 compounds of Nb and V, 7:1658
**VERTEBRAE**
**Biomedical Radiography**
Selective spinal angiography and embolization of tumours of the vertebral column, 7:1094
**Density**
Clinical determination of absolute density in bone utilizing single and dual energy compton scattering, 7:1098
**VESSELS**
*See CONTAINERS*
**VESSELS (PRESSURE)**
*See PRESSURE VESSELS*
**VISION**
**Biological Radiation Effects**
Kinetic perimetry (in the plateau region of the field) as a sensitive indicator of visual fatigue or saturation-like defects in retrobulbar anomalies, 7:1172
**VITAMIN B-12**
**Radioimmunoassay**
Methodology of HBsAg, HBsAb and vitamin B 12 concentration determination by RIA, 7:1065 (INIS-mf—6419)
**VITAMIN C**
*See ASCORBIC ACID*
**VITAMIN D-3**
*See CHOLECALCIFEROL*
**VITAMIN P**
*See BIOFLAVONOIDS*
**VOLCANIC ROCKS**
*See also BASALT*
*RHYOLITES*
**Natural Radioactivity**
Measurement of radioactivity in Mount St. Helens volcanic ash by x/sub gamma/ ray spectrometry, 7:1001
**VOLTAIC CELLS**
*See ELECTRIC BATTERIES*

## W

**WAGR REACTOR**
**Pressure Vessels**
Monitoring of irradiation effects on the pressure vessel steels of Calder, Chapelcross and Windscale Advanced Gas Cooled Reactor (WAGR) nuclear reactors, 7:369
**Spent Fuels**
Contribution of post-irradiation examination to the development of AGR fuel, 7:343
**WALKER CARCINOMA**
*See EXPERIMENTAL NEOPLASMS*
**WASTE BURIAL**
*See UNDERGROUND DISPOSAL*
**WASTE WATER**
**Radioactivity**
Waste water. Radioactivity total determination, 7:807 (CEA-CETAMA—7)
**WATER**
*See also DRINKING WATER*
*FRESH WATER*
*GROUND WATER*
*HEAVY WATER*
*SEAWATER*
*SURFACE WATERS*
*WASTE WATER*
**Chemical Analysis**
Applications of computer modeling to the genesis, exploration, and in-situ mining or uranium and vanadium deposits, 7:148
**Electric Conductivity**
Dissociative ionization of water induced by single-photon vibrational excitation, 7:830
**Photoionization**
Dissociative ionization of water induced by single-photon vibrational excitation, 7:830
**Photolysis**
Kinetics of the reactions of the hydroxyl radical with xylenes, 7:831
**Quantitative Chemical Analysis**
Isotopic analysis of water by mass spectrometry, 7:782
Laboratory investigation of water content within rock salt and its behavior in a temperature field of disposed high-level waste, 7:196
Mass spectrometric analysis of deuterium in water, 7:783
**Radiochemical Analysis**
Water analysis. Radium determination by scintillation, 7:803 (CEA-CETAMA—7)
**Radiolysis**
Carbon formation processes relevant to advanced carbon dioxide-cooled reactors, 7:357
Mechanisms involved in radiolytic carbon deposition from $CO_2/CO/CH_4$, 7:839
Oxidation of moderator graphites irradiated in carbon dioxide containing carbon monoxide, methane and water, 7:361
Survey of the principal parameters underlying carbon deposition on a 20% Cr/25% Ni/Niobium stabilised austenitic stainless steel from $CO_2/CO/CH_4/H_2O$ gas mixtures in DIDO 6V3 gas loops, 7:358
**Radiometric Analysis**
Water analysis. Beta radioactivity indexes, 7:806 (CEA-CETAMA—7)
**Reserves**
Water conservation in semiarid dryland agriculture, 7:1130 (IAEA-TECDOC—236)
**Resource Conservation**
Some aspects in relation to the efficient use of soils, water and fertilizers in Egypt, 7:1126 (IAEA-TECDOC—236)
**WATER COOLED REACTORS**
*See also BWR TYPE REACTORS*
*CIRUS REACTOR*
*PWR TYPE REACTORS*
*SGHWR REACTOR*
*SM-2 REACTOR*
**Fuel-Cladding Interactions**
Experience and plans with PCI protection in KWU LWR plants, 7:502 (IWGFPT—8)
**Neutron Transport**
Application of DUCKPOND to the OAK RIDGE PCA calculational blind test, 7:308
**WATER MODERATED REACTORS**
*See also BWR TYPE REACTORS*
*PWR TYPE REACTORS*
*SM-2 REACTOR*
**Spent Fuel Elements**
Some Windscale experience of the underwater examination of water reactor fuel assemblies, 7:284
**WATER SOLUTIONS**
*See AQUEOUS SOLUTIONS*
**WAZ 16**
*See NICKEL BASE ALLOYS*
**WEAKLY IONIZED GASES**
**Electric Conductivity**
Renormalization group method for the calculation of the conductivity of a dense weakly ionized plasma, 7:1477

**Plasma Diagnostics**
Study of the dense weakly ionized mercury plasma by the method of molecular dynamics, 7:1476

**WEATHER**
**Environmental Effects**
Climate impact assessment: United States, 7:980 (NP—2900749)

**WELDED JOINTS**
**Fracture Properties**
Fracture toughness and crack growth resistance of submerged arc and manual metal arc weldments in A533B plate, 7:667

**WELDS**
*See WELDED JOINTS*

**WELL LOGGING EQUIPMENT**
**Design**
Development of standard series of radiometric probes for ore logging, 7:978 (INIS-mf—6422)
**Performance**
Practical experience with KR-1010 radiometer in ZUD coal mines at Zbuch, 7:3 (INIS-mf—6422)

**WEST GERMANY**
*See FEDERAL REPUBLIC OF GERMANY*

**WHITE DWARF STARS**
**X-Ray Spectra**
Observation of galactic super-soft x-ray using the satellite K-9M-60, 7:1366

**WHOLE-BODY IRRADIATION**
**Biological Radiation Effects**
Total body irradiation on bone marrow transplantation, 7:1084 (INIS-mf—6531)

**WIND POWER PLANTS**
**Demonstration Programs**
Wind energy systems act of 1980, 7:273 (GPO—56-735)
**Planning**
Wind energy systems act of 1980, 7:273 (GPO—56-735)

**WINDSCALE ADV. GAS-COOLED REACTOR**
*See WAGR REACTOR*

**WOLSUNG-1 REACTOR**
**Construction**
Design and construction progress on Gentilly 2, Cordoba, Point Lepreau, and Wolsung projects, 7:382

**WOMEN**
**Radionuclide Kinetics**
Main regularities of $^{90}Sr$ migration in mother-fetus biological system. Chapter 5.2, 7:1181

**WOOD BURNING FURNACES**
**Environmental Impacts**
Impact of residential wood combustion on urban air quality: first ambient measurements, 7:982

**WORKERS**
*See PERSONNEL*

**WOUNDS**
**Contamination**
Four observations of surgical treatment of wounds contaminated by radionuclides, 7:1186
**Healing**
Peculiarities of stomach injury healing in dogs irradiated with 350 R and non-irradiated, 7:1226

**WWER TYPE REACTORS**
**Pressure Vessels**
Aspects of design integrity for preparation of rules and standards for nuclear power plants in the Czechoslovak Socialist Republic, 7:312
**Waste Heat**
Use of nuclear heat for a food and agricultural complex. Conclusions of model solution for reference locality of WWER type power plants in Czechoslovakia, 7:1134 (INIS-mf—6420)

**WYOMING**
**Coal Mines**
Air-quality impacts from Western Surface-coal-mining operations, 7:999

## X

**X RADIATION**
*See also HARD X RADIATION*
*SOFT X RADIATION*
**Radiotherapy**
Comparative evaluation of treatment of patients with syringomyelia with X-rays and radioactive iodine, 7:1236

**XENON**
O-positronium pick-off quenching in dense gases, 2. Experimental results in xenon and carbon dioxide, 7:1432
**Ion-Atom Collisions**
Autoionization in multiply-charged ion-atom collisions, 7:1425
Theory of inner-shell vacancy formation in superheavy quasimolecules, 7:1409

**XENON 133**
**Diagnostic Uses**
Portable device for the measurement of regional cerebral blood flow in the ICU and Or using Cd Te detectors and a fourier transform based data analysis, 7:1087

**XENON IONS**
**Beam Production**
High-current DC heavy-ion source, 7:1395

**XENOTIME**
**Physical Radiation Effects**
Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation, 7:718

**X-RAY DOSIMETRY**
**Potassium Chlorides**
KCl crystal for dosimetry of hard X-ray and gamma radiation, 7:968

**X-RAY EMISSION ANALYSIS**
*See also X-RAY FLUORESCENCE ANALYSIS*
Studies of forensic related trace elemental problems by the particle induced X-ray emission (PIXE) method, 7:777

**X-RAY FLUORESCENCE ANALYSIS**
**X-Ray Sources**
Fluorescent X-ray spectroscopic analysis using radioisotopes, 7:762

**X-RAY GALAXIES**
**X-Ray Spectra**
Observation of galactic super-soft x-ray using the satellite K-9M-60, 7:1366

**X-RAY RADIOGRAPHY (BIOMEDICAL)**
*See BIOMEDICAL RADIOGRAPHY*

**X-RAY SPECTROMETERS**
**Specifications**
Astro 4 - a sounding rocket programme of the X-ray astronomy, 7:947

**X-RAY SPECTROSCOPY**
X-ray spectrometry. Chapter 3. Section 2, 7:749

**XYLENES**
**Chemical Reaction Kinetics**
Kinetics of the reactions of the hydroxyl radical with xylenes, 7:831

## Y

**YANKEE CONNECTICUT REACTOR**
*See CONNECTICUT YANKEE REACTOR*

**YIELD (FISSION)**
*See FISSION YIELD*

**YOSHIDA SARCOMA**
*See EXPERIMENTAL NEOPLASMS*

**Y*RESONANCES**
Kaon-nucleus interactions, 7:1502 (TRI—79-1)

**YTTERBIUM**
**Activation Analysis**
Geochemical study of a lamprophyre dike near the WIPP site, 7:212

**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**YTTRIUM**
**Distribution Functions**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**Solvent Extraction**
Extraction of selected transplutonium(III) and lanthanide(III) ions by dihexyl-N,N-diethylcarbamoylmethylphosphonate from aqueous nitrate media, 7:746
**YTTRIUM HYDRIDES**
**Enthalpy**
Enthalpy of formation of YHsub(1.994) and YHsub(2.792), 7:817
**YUGOSLAVIA**
**Radioecology**
Radioecology of uranium and radium with special reference to a uranium mining area, 7:1006 (IAEA-TECDOC—229)

## Z

**ZEA MAYS**
*See MAIZE*
**ZEOLITES**
*See also MORDENITE*
**Comparative Evaluations**
Studies on sintered titanates and zeolites as hosts for medium-level radioactive waste, 7:209
**Inclusions**
Influence or preparation methods on structural integrity of Na-A and Na-α zeolites and on occlusion of aluminum compounds studied by H-NMR of sorbed water and ammonia, 7:730
**ZINC**
**Ion Collisions**
Kβ/Kα intensity ratios and energy shifts of Kβ rays produced by N-ion impact, 7:1399
**ZINC COMPLEXES**
**Enthalpy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**Entropy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**Free Energy**
Regularity in the changes of the thermodynamic functions associated with the formation of mononuclear complexes, 7:815
**ZIRCALOY**
**Corrosion**
Development of structural engineered barriers for the long-term containment of nuclear waste, 7:217
**Melting Points**
Melting process to condition decladding hulls generated by the reprocessing of LWR and FBR spent fuels, 7:211
**Physical Radiation Effects**
Influence of environmental variables and irradiation on iodine stress corrosion crack initiation and growth in Zircaloy, 7:653 (IWGFPT—7)
**Plasticity**
Plastic instability of Zircaloy cladding submitted to LOCA conditions, 7:585
**Stress Corrosion**
Experiments to settle an ISCC hypothesis for Zry-tubing (Iodine stress corrosion cracking), 7:503 (IWGFPT—8)
Influence of environmental variables and irradiation on iodine stress corrosion crack initiation and growth in Zircaloy, 7:653 (IWGFPT—7)
**ZIRCALOY 2**
**Elongation**
Analysis of pressure tube elongation and end shield interactions in the CANDU reactors, 7:389
**Stress Corrosion**
Stress corrosion cracking of Zircaloy. The use of laboratory data to predict in-reactor behaviour, 7:495 (IWGFPT—8)
Threshold values characterizing iodine-induced SCC of Zircaloys, 7:494 (IWGFPT—8)
**ZIRCALOY 4**
**Creep**
Prediction of creep transients in Zircaloy fuel cladding using anelastic strain model, 7:522
**Phase Transformations**
Model for the kinetics of the α diversable β phase transformation in Zircaloy-4, 7:654 (IWGFPT—7)
**Stress Corrosion**
Threshold values characterizing iodine-induced SCC of Zircaloys, 7:494 (IWGFPT—8)
**ZIRCON**
**Age Estimation**
Internal isochrone method in accessory zircon dating, 7:1271
**Physical Radiation Effects**
Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation, 7:718
Metamictization by heavy ion bombardment of α-quartz, zircon, monazite and nitride structures (3 MeV ion beams), 7:719
**ZIRCONIUM**
**Activation Analysis**
Analysis of zirconium and zirconium oxide. Hafnium determination by activation, 7:791 (CEA-CETAMA—7)
Geochemical study of a lamprophyre dike near the WIPP site, 7:212
**Chemical Analysis**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
**Corrosion**
Metallographic investigation into interaction of cesium with some metals, 7:701
**Crystal-Phase Transformations**
β/α phase transformation in zirconium and certain zirconium based alloys, 7:644
**Heat Treatments**
Heat treatment of refractory metals in vacuum, 7:655 (KFTI—78-25)
**ZIRCONIUM 90 TARGET**
**Uranium 238 Reactions**
Fission properties of very heavy nuclei produced in deep-inelastic collisions, 7:1603
**ZIRCONIUM ALLOYS**
*See also ZIRCONIUM BASE ALLOYS*
**Superconductivity**
Superconductivity in scandium-zirconium systems, 7:1655
**ZIRCONIUM BASE ALLOYS**
*See also ZIRCALOY*
**Chemical Analysis**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
Analysis of zirconium and its alloys. Spectrographic determination of impurities or alloy elements, 7:802 (CEA-CETAMA—7)
**Crystal-Phase Transformations**
β/α phase transformation in zirconium and certain zirconium based alloys, 7:644
Sequence of phase transformations in the Zr-14AT%AL alloy, 7:643

**ZIRCONIUM NITRIDES**
**Physical Radiation Effects**
Metamictization by heavy ion bombardment of α-quartz, zircon, monazite and nitride structures (3 MeV ion beams), 7:719
**ZIRCONIUM OXIDES**
**Activation Analysis**
Analysis of zirconium and zirconium oxide. Hafnium determination by activation, 7:791 (CEA-CETAMA—7)
**Chemical Analysis**
Analysis of zirconium and its compounds and alloys. Inorganic impurities spectrographic determination, 7:801 (CEA-CETAMA—7)
**ZIRCONOLITE**
**Calcination**
Calcination studies on perovskite, zirconolite, barium hollandite and SYNROC-B, 7:675
**Physical Radiation Effects**
Experimental study of structural damage in crystalline nuclear waste phases from fission fragment irradiation, 7:718

# CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which reports announced in this publication were prepared are included in this index.


| *Contract No.* | *Abstract No.* | *Report No.* |
|---|---|---|
| **ER-78-S-05-6030** | **Georgia Inst. of Tech., Atlanta** | |
| | 7:831 | Journal of Physical Chemistry 85 NO. 20. 2913-2916 (1 Oct 1981). |
| **W-7405-ENG-26** | | |
| | 7:188 | (1981). |
| **W-7405-ENG-48** | **Lawrence Berkeley Lab., CA** | |
| | 7:812 | Journal of Physical Chemistry 85 NO. 20. 2886-2895 (1 Oct 1981). |
| **W-7405-ENG-48** | **Lawrence Berkeley Lab., CA** | |
| | 7:830 | Journal of Physical Chemistry 85 NO. 20. 2882-2884 (1 Oct 1981). |
| **W-7405-ENG-48** | **Univ. of California, Livermore** | |
| | 7:1068 | Cell and Tissue Kinetics 13 299-308 (1980). |


*Contract No.* *Abstract No.* *Report No.*

# ORDER NUMBER CORRELATION

This correlation list is provided for those organizations where document storage is alphanumeric by report number and request may be received by order number. For other information about a document (abstract number, distribution category, availability, and price), please refer to the Report Number Index.

| *Order No.* | *Report No.* | *Order No.* | *Report No.* | *Order No.* | *Report No.* |
|---|---|---|---|---|---|
| DE81700032 | CONF-780284—(Vol.1) | | | | |
| DE81700032 | INP—1014/PL | | | | |
| DE81904186 | NYSERDA—81-6 | | | | |
| DE82900069 | CONF-8004173—11 | | | | |
| DE82900169 | CONF-7905120— | | | | |
| DE82900406 | P—300-80-033 | | | | |
| DE82900425 | BCR-L—1245 | | | | |
| DE82900425 | USBM-J—0318093 | | | | |
| DE82900461 | NP—2900461 | | | | |
| DE82900592 | P—800-81-003 | | | | |
| DE82900595 | P—800-81-005 | | | | |
| DE82900749 | NP—2900749 | | | | |
| DE82900750 | NP—2900750 | | | | |
| DE82900890 | NP—2900890 | | | | |
| DE82900891 | NP—2900891 | | | | |
| DE82900892 | NP—2900892 | | | | |
| DE82900893 | NP—2900893 | | | | |
| DE82900894 | NP—2900894 | | | | |

# REPORT NUMBER INDEX

The numbers assigned to all reports cited in the publication appear in the first column of the index. Cross reference information and/or availability are included as appropriate. Abbreviations used in the availability column are elaborated at the end of the index. To expedite the filing of orders for reports from NTIS and TIC, as order number in the form, DE810000001, appears in column 3. Requesters are urged to use this order number where provided. In column 4, one or more DOE distribution categories are indicated, e.g. , STD-10, MN-25. STD indicates distriburion was made in full size copy; MN indicates microcopy distribution. These category numbers are included to assist DOE librarians in responding to requests for reports in their collections. The UC (Unclassified Distribution Categories) are defined in DOE/TIC-4500, available from TIC. The Citation numbers are given in column 5.

| *Report No.* | *Availability* | *Order No.* | *Distribution Category* | *Abstract No.* |
|---|---|---|---|---|
| **AECL-** | | | | |
| 6885 | NTIS (US Sales Only) | | | 7:442 |
| 7056 | NTIS (US Sales Only) | | | 7:244 |
| 7056 | NTIS (US Sales Only) | | | 7:274 |
| 7056 | NTIS (US Sales Only) | | | 7:276 |
| 7056 | NTIS (US Sales Only) | | | 7:443 |
| 7056 | NTIS (US Sales Only) | | | 7:523 |
| 7056 | NTIS (US Sales Only) | | | 7:524 |
| 7056 | NTIS (US Sales Only) | | | 7:525 |
| 7056 | NTIS (US Sales Only) | | | 7:526 |
| 7056 | NTIS (US Sales Only) | | | 7:527 |
| 7056 | NTIS (US Sales Only) | | | 7:528 |
| 7056 | NTIS (US Sales Only) | | | 7:529 |
| 7056 | NTIS (US Sales Only) | | | 7:530 |
| 7056 | NTIS (US Sales Only) | | | 7:531 |
| 7056 | NTIS (US Sales Only) | | | 7:532 |
| 7056 | NTIS (US Sales Only) | | | 7:533 |
| 7056 | NTIS (US Sales Only) | | | 7:534 |
| 7056 | NTIS (US Sales Only) | | | 7:535 |
| 7056 | NTIS (US Sales Only) | | | 7:536 |
| 7056 | NTIS (US Sales Only) | | | 7:537 |
| 7056 | NTIS (US Sales Only) | | | 7:545 |
| 7056 | NTIS (US Sales Only) | | | 7:546 |
| **AERE-TP-** | | | | |
| 843 | NTIS (US Sales Only) | | | 7:646 |
| 843 | NTIS (US Sales Only) | | | 7:647 |
| 843 | NTIS (US Sales Only) | | | 7:835 |
| **BCR-L-** | | | | |
| 1245 | | DE82900425 | MN-88 | 7:4 |
| **CEA-CETAMA-** | | | | |
| 7 | NTIS (US Sales Only) | | | 7:791 |
| 7 | NTIS (US Sales Only) | | | 7:792 |
| 7 | NTIS (US Sales Only) | | | 7:793 |
| 7 | NTIS (US Sales Only) | | | 7:794 |
| 7 | NTIS (US Sales Only) | | | 7:795 |
| 7 | NTIS (US Sales Only) | | | 7:796 |
| 7 | NTIS (US Sales Only) | | | 7:797 |
| 7 | NTIS (US Sales Only) | | | 7:798 |
| 7 | NTIS (US Sales Only) | | | 7:799 |
| 7 | NTIS (US Sales Only) | | | 7:800 |
| 7 | NTIS (US Sales Only) | | | 7:801 |
| 7 | NTIS (US Sales Only) | | | 7:802 |
| 7 | NTIS (US Sales Only) | | | 7:803 |
| 7 | NTIS (US Sales Only) | | | 7:804 |
| 7 | NTIS (US Sales Only) | | | 7:805 |
| 7 | NTIS (US Sales Only) | | | 7:806 |
| 7 | NTIS (US Sales Only) | | | 7:807 |
| 7 | NTIS (US Sales Only) | | | 7:808 |
| 7 | NTIS (US Sales Only) | | | 7:809 |
| 7 | NTIS (US Sales Only) | | | 7:810 |
| **CONF-7704126-** | (Expert consultation on better exploitation of plant nutrients, Rome, Italy, 18-22 Apr 1977) Rome, Italy; Food and Agriculture Organization (1978). | | | 7:1136 |
| **CONF-7708127-** | (5. conference of Czechoslovak physicists, Kosice, Czechoslovakia, 29 Aug-1 Sep 1977) | | | |
| (Vol.1) | *See* INIS-mf-6479 | | | 7:1553 |
| (Vol.1) | *See* INIS-mf-6479 | | | 7:1555 |
| (Vol.1) | *See* INIS-mf-6479 | | | 7:1661 |
| **CONF-7709177-** | (11. international school for young scientistis on high energy physics and relativistic nuclear physics, Gomel, Byelorussian SSR, 12-23 Sep 1977) *See* JINR-D-2-11707 | | | 7:1481 |
| **CONF-7709222-** | (School on radiation damage physics of solids, Alushta, Ukrainian SSR, 27 Sep-7 Oct 1977) *See* KFTI-78-64 | | | 7:541 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| **CONF-780284-** | (16. winter school, Bielsko-Biala, Poland, 20 Feb-4 Mar 1978) | | | |
| (Vol.1) | *See* INP-1014/PL | DE81700032 | | 7:1592 |
| **CONF-7804190-** | (Workshop on radioimmunoassay, Hradec Kralove, Czechoslovakia, 27-28 Apr 1978) | | | |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1053 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1054 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1055 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1056 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1057 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1058 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1059 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1060 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1061 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1062 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1063 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1064 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1065 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1066 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1067 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1109 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1110 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1111 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1112 |
| (Summ.) | *See* INIS-mf-6419 | | | 7:1243 |
| **CONF-7804193-** | (Seminar on science and its impact on society--Indian experience, New Delhi, India, 22-23 Apr 1978) | | | |
| | New Delhi, India; Indian National Science Academy (1978). | | | 7:1051 |
| **CONF-7805204-** | (National seminar on Australia's mineral energy resources, Sydney, Australia, 22-23 May 1978) | | | |
| | Sydney, Australia; Earth Resources Foundation, Sydney University (1978). | | | 7:124 |
| **CONF-7805226-** | (Meeting on solid state track detection of radiations, Kumatori, Osaka, Japan, 29-30 May 1978) | | | |
| (Summ.) | *See* KURRI-TR-190 | | | 7:913 |
| (Summ.) | *See* KURRI-TR-190 | | | 7:936 |
| (Summ.) | *See* KURRI-TR-190 | | | 7:937 |
| (Summ.) | *See* KURRI-TR-190 | | | 7:938 |
| (Summ.) | *See* KURRI-TR-190 | | | 7:939 |
| (Summ.) | *See* KURRI-TR-190 | | | 7:940 |
| **CONF-7805227-** | (Meeting on the state of natural radioactivities in the environment, Kumatori, Osaka, Japan, 22 Mar 1978) | | | |
| | *See* KURRI-TR-179 | | | 7:280 |
| | *See* KURRI-TR-179 | | | 7:987 |
| | *See* KURRI-TR-179 | | | 7:988 |
| **CONF-780612-** | (Symposium on advances in radiation protection monitoring, Stockholm, Sweden, 26-30 Jun 1978) | | | |
| | Vienna; IAEA (1979). | | | 7:1221 |
| **CONF-7808134-** | (NATO Advanced Study Institute, Calgary, Canada, 26 Aug-2 Sep 1978) | | | |
| | Dordrecht, Netherlands; Reidel (1979). | | | 7:1671 |
| **CONF-7809244-** | (Conference on complex metallurgy, Bad Harzburg, F.R. Germany, 20-22 Sep 1978) | | | |
| | London, England; Institution of Mining and Metallurgy (1978). | | | 7:160 |
| **CONF-781049-** | (6. conference on particle accelerator, Dubna, USSR, 11-13 Oct 1978) | | | |
| (Vol.2) | *See* INIS-mf-6295 | | | 7:909 |
| **CONF-781065-** | (Vessel concepts for gas-cooled reactors, Lausanne, Switzerland, 23-27 Oct 1978) | | | |
| (Summ.) | *See* IWGHTR-2 | | | 7:332 |
| (Summ.) | *See* IWGHTR-2 | | | 7:333 |
| (Summ.) | *See* IWGHTR-2 | | | 7:334 |
| (Summ.) | *See* IWGHTR-2 | | | 7:335 |
| (Summ.) | *See* IWGHTR-2 | | | 7:336 |
| (Summ.) | *See* IWGHTR-2 | | | 7:337 |
| (Summ.) | *See* IWGHTR-2 | | | 7:338 |
| (Summ.) | *See* IWGHTR-2 | | | 7:339 |
| (Summ.) | *See* IWGHTR-2 | | | 7:445 |
| (Summ.) | *See* IWGHTR-2 | | | 7:446 |
| (Summ.) | *See* IWGHTR-2 | | | 7:447 |
| (Summ.) | *See* IWGHTR-2 | | | 7:448 |
| (Summ.) | *See* IWGHTR-2 | | | 7:449 |
| (Summ.) | *See* IWGHTR-2 | | | 7:555 |
| **CONF-7810242-** | (1. all-union scientific--technical conference on medical production radiation sterilization, Moscow, USSR, 24-26 Oct 1978) | | | |
| (Summ.) | *See* INIS-mf-5673 | | | 7:836 |
| (Summ.) | *See* INIS-mf-5673 | | | 7:1137 |
| (Summ.) | *See* INIS-mf-5673 | | | 7:1138 |
| (Summ.) | *See* INIS-mf-5673 | | | 7:1139 |
| (Summ.) | *See* INIS-mf-5673 | | | 7:1140 |
| **CONF-7810261-** | (Meeting of the science and industry forum of the Australian Academy of Science, Canberra, Australia, 6-7 Oct 1978) | | | |
| | Canberra, Australia; Australian Academy of Science (1979). | | | 7:235 |
| **CONF-781144-** | (2. US-Japan seminar on HTGR safety technology, Fuji, Japan, 24-25 Nov 1978) | | | |
| (Vol.1) | Tokai, Ibaraki; JAERI (1979). | | | 7:601 |
| (Vol.2) | Tokai, Ibaraki; JAERI (1979). | | | 7:602 |

| *Report No.* | *Availability* | *Order No.* | *Distribution Category* | *Abstract No.* |
|---|---|---|---|---|
| **CONF-781189-** | (Conference on dense plasmas, Pasadena, CA, USA, 14-16 Nov 1978) | | | |
| | Vienna, Austria; International Atomic Energy Agency (1978). | | | 7:1031 |
| **CONF-781289-** | (National seminar on the use of energy resources in agriculture and food, Olomouc, Czechoslovakia, 13-14 Dec 1978) | | | |
| | *See* INIS-mf-6420 | | | 7:1133 |
| | *See* INIS-mf-6420 | | | 7:1134 |
| | *See* INIS-mf-6420 | | | 7:1135 |
| **CONF-790195-** | (Meeting on research reactors using middle-enrichment uranium, Kumatori, Osaka, Japan, 30 Jan 1979) | | | |
| | *See* KURRI-TR-192 | | | 7:542 |
| | *See* KURRI-TR-192 | | | 7:543 |
| **CONF-790247-** | (1. national conference of the Australian Institute of Energy, Newcastle, Australia, 5-9 Feb 1979) | | | |
| (Vol.1) | Newcastle, Australia; Australian Institute of Energy (1979). | | | 7:998 |
| **CONF-790270-** | (Groundwater pollution conference, Perth, Australia, 19-23 Feb 1979) | | | |
| | Canberra, Australia; Australian Government Publishing Service (1980). | | | 7:232 |
| **CONF-7903145-** | (Symposium on the possibilities of the application of irradiation in agriculture and food industry, Budapest, Hungary, 15-16 Mar 1979) | | | |
| | *See* INIS-mf-6050 | | | 7:1141 |
| **CONF-7904171-** | (Workshop of the Society of Urologic Oncology and Endocrinology, Amsterdam, Netherlands, 27-28 Apr 1979) | | | |
| | Amsterdam, Netherlands; Excerpta Medica (1980). | | | 7:1099 |
| **CONF-7905120-** | (New Mexico Bureau of Mines and Mineral Resources conference, Albuquerque, NM, USA, 13-16 May 1979) | | | |
| | | DE82900169 | MN-51 | 7:59 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 22-35(1980) | | | 7:100 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 36-39(1980) | | | 7:101 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 59-69(1980) | | | 7:102 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 75-85(1980) | | | 7:103 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 86-97(1980) | | | 7:104 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 98-106(1980) | | | 7:105 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 107-115(1980) | | | 7:106 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 122-130(1980) | | | 7:107 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 131-138(1980) | | | 7:108 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 139-144(1980) | | | 7:109 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 145-152(1980) | | | 7:110 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 153-161(1980) | | | 7:111 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 162-171(1980) | | | 7:112 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 172-184(1980) | | | 7:113 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 202-207(1980) | | | 7:114 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 208-214(1980) | | | 7:115 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 215-225(1980) | | | 7:116 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 226-229(1980) | | | 7:117 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 230-239(1980) | | | 7:118 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 244-251(1980) | | | 7:119 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 262-268(1980) | | | 7:120 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 292-298(1980) | | | 7:121 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 299-303(1980) | | | 7:122 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 17-21(1980) | | | 7:136 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 40-51(1980) | | | 7:137 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 52-58(1980) | | | 7:138 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 70-74(1980) | | | 7:139 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 185-194(1980) | | | 7:140 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 195-201(1980) | | | 7:141 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 240-243(1980) | | | 7:142 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 252-261(1980) | | | 7:143 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 269-275(1980) | | | 7:144 |

| *Report No.* | *Availability* | *Order No.* | *Distribution Category* | *Abstract No.* |
|---|---|---|---|---|
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 276-283(1980) | | | 7:145 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 284-291(1980) | | | 7:146 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 304-312(1980) | | | 7:147 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 355-367(1980) | | | 7:148 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 368-379(1980) | | | 7:149 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 380-389(1980) | | | 7:150 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 340-343(1980) | | | 7:155 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 313-319(1980) | | | 7:233 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 320-333(1980) | | | 7:234 |
| | Mem. - N.M. Bur. Mines Miner. Resour., No. 38, 116-121(1980) | | | 7:1262 |
| **CONF-7905193-** | (Hadron electromagnetic interactions in the resonance energy range, Kharkov, Ukrainian SSR, 30 May-1 Jun 1979) | | | |
| | *See* KFTI-80-6 | | | 7:1482 |
| | *See* KFTI-80-6 | | | 7:1500 |
| | *See* KFTI-79-48 | | | 7:1558 |
| | *See* KFTI-79-48 | | | 7:1559 |
| | *See* KFTI-79-48 | | | 7:1560 |
| | *See* KFTI-79-48 | | | 7:1561 |
| | *See* KFTI-79-48 | | | 7:1562 |
| | *See* KFTI-79-48 | | | 7:1563 |
| | *See* KFTI-79-48 | | | 7:1564 |
| | *See* KFTI-79-48 | | | 7:1565 |
| | *See* KFTI-79-48 | | | 7:1566 |
| | *See* KFTI-79-48 | | | 7:1571 |
| | *See* KFTI-79-48 | | | 7:1572 |
| | *See* KFTI-79-48 | | | 7:1573 |
| | *See* KFTI-80-6 | | | 7:1574 |
| | *See* KFTI-80-6 | | | 7:1575 |
| | *See* KFTI-80-6 | | | 7:1576 |
| | *See* KFTI-80-6 | | | 7:1577 |
| | *See* KFTI-80-6 | | | 7:1578 |
| | *See* KFTI-79-48 | | | 7:1621 |
| | *See* KFTI-79-48 | | | 7:1622 |
| | *See* KFTI-79-48 | | | 7:1623 |
| **CONF-7905199-** | (Meeting on calorimetery and thermal analysis, Marseille, France, 10-11 May 1979) | | | |
| | Marseille, France; Association Francaise de Calorimetrie et d'Analyse Thermique ([nd]). | | | 7:811 |
| **CONF-7906226-** | (Meeting on technical standards and legislation, Koeln, F.R. Germany, 12-13 Jun 1979) | | | |
| | Berlin, Germany, F.R.; Beuth (1979). | | | 7:430 |
| **CONF-7906227-** | (Origins of optical activity in nature, British Columbia, Canada, 5-6 Jun 1979) | | | |
| | Amsterdam, Netherlands; Elsevier Scientific (1979). | | | 7:740 |
| **CONF-790820-** | (3. international conference on mechanical behaviour of materials, Cambridge, UK, 20-24 Aug 1979) | | | |
| (Vol.2) | Oxford, England; Pergamon (1980). | | | 7:640 |
| **CONF-7908110-** | (Kaon factory workshop, Vancouver, Canada, 13-14 Aug 1979) | | | |
| | *See* TRI-79-1 | | | 7:1483 |
| | *See* TRI-79-1 | | | 7:1484 |
| | *See* TRI-79-1 | | | 7:1485 |
| | *See* TRI-79-1 | | | 7:1486 |
| | *See* TRI-79-1 | | | 7:1501 |
| | *See* TRI-79-1 | | | 7:1502 |
| | *See* TRI-79-1 | | | 7:1503 |
| | *See* TRI-79-1 | | | 7:1504 |
| | *See* TRI-79-1 | | | 7:1505 |
| | *See* TRI-79-1 | | | 7:1531 |
| | *See* TRI-79-1 | | | 7:1579 |
| | *See* TRI-79-1 | | | 7:1580 |
| | *See* TRI-79-1 | | | 7:1581 |
| | *See* TRI-79-1 | | | 7:1582 |
| | *See* TRI-79-1 | | | 7:1624 |
| | *See* TRI-79-1 | | | 7:1625 |
| | *See* TRI-79-1 | | | 7:1626 |
| **CONF-7908114-** | (Fundamental problems of theoretical and mathematical physics conference, Dubna, USSR, 23-27 Aug 1979) | | | |
| | *See* JINR-D-12831 | | | 7:1287 |
| **CONF-7908149-** | (Australian Institute of Mining and Metallurgy conference, Perth, Australia, 12-17 Aug 1979) | | | |
| | Melbourne, Australia; Australasian Institute of Mining and Metallurgy (1979). | | | 7:123 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| CONF-7908154- | (1. international seminar on assuring structural integrity of steel reactor pressure vessels, Berlin, F.R. Germany, 20-21 Aug 1979) | | | |
| | London, England; Applied Science (1980). | | | 7:459 |
| CONF-7908156- | (Conference on the recent advances in statistical mechanics, Poiana Brasov, Romania, 30 Aug-15 Sep 1979) | | | |
| | *See* INIS-mf-6084 | | | 7:1441 |
| | *See* INIS-mf-6084 | | | 7:1646 |
| | *See* INIS-mf-6084 | | | 7:1647 |
| | *See* INIS-mf-6084 | | | 7:1648 |
| CONF-7908164- | (7. A.I.N.S.E. radiation biology conference, Lucas Heights, Australia, 20-21 Aug 1979) | | | |
| (Absts.) | *See* INIS-mf-6531 | | | 7:934 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1084 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1085 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1143 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1144 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1145 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1146 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1147 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1148 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1149 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1150 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1151 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1152 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1153 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1154 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1155 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1156 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1157 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1158 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1159 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1160 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1161 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1162 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1163 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1164 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1165 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1166 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1167 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1168 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1169 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1170 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1171 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1245 |
| (Absts.) | *See* INIS-mf-6531 | | | 7:1246 |
| CONF-790928- | (International meeting on monitoring of Pu-contaminated waste, Ispra, Italy, 25-28 Sep 1979) | | | |
| | *See* EUR-6629 | | | 7:236 |
| CONF-7909219- | (Nuclear methods in mining, geology, geophysics and geochemistry, Visolaje, Czechoslovakia, 11-14 Sep 1979) | | | |
| (Absts.) | *See* INIS-mf-6422 | | | 7:2 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:3 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:11 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:12 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:58 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:249 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:972 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:973 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:978 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:1032 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:1033 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:1265 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:1266 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:1267 |
| (Absts.) | *See* INIS-mf-6422 | | | 7:1268 |
| CONF-7909220- | (School for young high energy physicists, Chilton, Didcot, UK, 10-27 Sep 1979) | | | |
| | *See* RL-80-043 | | | 7:941 |
| CONF-791051- | (3. ASTM-EURATOM symposium on reactor dosimetry, Ispra, Italy, 1-5 Oct 1979) | | | |
| (Vol.1) | *See* EUR-6813(Vol.1) | | | 7:289 |
| (Vol.1) | *See* EUR-6813(Vol.1) | | | 7:290 |
| (Vol.1) | *See* EUR-6813(Vol.1) | | | 7:291 |
| (Vol.1) | *See* EUR-6813(Vol.1) | | | 7:292 |
| (Vol.1) | *See* EUR-6813(Vol.1) | | | 7:444 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:237 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:293 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:294 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:295 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:296 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:395 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:433 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:434 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:435 |
| (Vol.2) | *See* EUR-6813(Vol.2) | | | 7:436 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:437 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:438 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:540 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:925 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:926 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:927 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:928 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:929 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:930 |
| (Vol.2) | See EUR-6813(Vol.2) | | | 7:1638 |
| **CONF-7910247-** | (Diagnosis of mammary gland disorders. Piestany, Czechoslovakia. 3-5 Oct 1979) | | | |
| (Absts.) | See INIS-mf-6421 | | | 7:1113 |
| (Absts.) | See INIS-mf-6421 | | | 7:1244 |
| **CONF-7910250-** | (CAPG symposium on solar-terrestrial physics, Ashkhabad, USSR, 22-28 Oct 1979) | | | |
| (Summ.) | See INIS-mf-6385 | | | 7:1280 |
| (Summ.) | See INIS-mf-6385 | | | 7:1281 |
| (Summ.) | See INIS-mf-6385 | | | 7:1282 |
| (Summ.) | See INIS-mf-6385 | | | 7:1283 |
| (Summ.) | See INIS-mf-6385 | | | 7:1284 |
| (Summ.) | See INIS-mf-6385 | | | 7:1285 |
| (Summ.) | See INIS-mf-6385 | | | 7:1286 |
| **CONF-7911158-** | (9. international symposium on the interaction of fast neutrons with nuclei, Gaussig, German Democratic Republic, 26-30 Nov 1979) | | | |
| | See ZfK-410 | | | 7:942 |
| | See ZfK-410 | | | 7:1557 |
| | See ZfK-410 | | | 7:1585 |
| | See ZfK-410 | | | 7:1706 |
| | See ZfK-410 | | | 7:1707 |
| **CONF-7911162-** | (Regional seminar on the use of isotopes and radiation techniques in soil and water conservation studies for developing countries in African region, Khartoum, Sudan, 12-17 Nov 1979) | | | |
| | See IAEA-TECDOC-236 | | | 7:1122 |
| | See IAEA-TECDOC-236 | | | 7:1123 |
| | See IAEA-TECDOC-236 | | | 7:1124 |
| | See IAEA-TECDOC-236 | | | 7:1125 |
| | See IAEA-TECDOC-236 | | | 7:1126 |
| | See IAEA-TECDOC-236 | | | 7:1127 |
| | See IAEA-TECDOC-236 | | | 7:1128 |
| | See IAEA-TECDOC-236 | | | 7:1129 |
| | See IAEA-TECDOC-236 | | | 7:1130 |
| | See IAEA-TECDOC-236 | | | 7:1131 |
| | See IAEA-TECDOC-236 | | | 7:1132 |
| **CONF-800283-** | (Conference on molecular physics and quantum chemistry, Sydney, Australia, 17-20 Feb 1980) | | | |
| | Wollongong, Austrailia: Universty of Wollongong (1980). | | | 7:1397 |
| **CONF-800287-** | (7. meeting physics and electronics, Berlin, German Democratic Republic, 11-14 Feb 1980) | | | |
| | See INIS-mf-6449 | | | 7:712 |
| | See INIS-mf-6449 | | | 7:713 |
| | See INIS-mf-6449 | | | 7:1649 |
| **CONF-800331-** | (IAEA specialists meeting, Blackpool, UK, 17-21 Mar 1980) | | | |
| | See IWGFPT-7 | | | 7:298 |
| | See IWGFPT-7 | | | 7:299 |
| | See IWGFPT-7 | | | 7:300 |
| | See IWGFPT-7 | | | 7:301 |
| | See IWGFPT-7 | | | 7:302 |
| | See IWGFPT-7 | | | 7:471 |
| | See IWGFPT-7 | | | 7:472 |
| | See IWGFPT-7 | | | 7:473 |
| | See IWGFPT-7 | | | 7:474 |
| | See IWGFPT-7 | | | 7:475 |
| | See IWGFPT-7 | | | 7:476 |
| | See IWGFPT-7 | | | 7:477 |
| | See IWGFPT-7 | | | 7:478 |
| | See IWGFPT-7 | | | 7:479 |
| | See IWGFPT-7 | | | 7:480 |
| | See IWGFPT-7 | | | 7:481 |
| | See IWGFPT-7 | | | 7:482 |
| | See IWGFPT-7 | | | 7:483 |
| | See IWGFPT-7 | | | 7:484 |
| | See IWGFPT-7 | | | 7:485 |
| | See IWGFPT-7 | | | 7:486 |
| | See IWGFPT-7 | | | 7:487 |
| | See IWGFPT-7 | | | 7:488 |
| | See IWGFPT-7 | | | 7:550 |
| | See IWGFPT-7 | | | 7:551 |
| | See IWGFPT-7 | | | 7:552 |
| | See IWGFPT-7 | | | 7:553 |
| | See IWGFPT-7 | | | 7:653 |
| | See IWGFPT-7 | | | 7:654 |
| | See IWGFPT-7 | | | 7:703 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| CONF-800359- | (NEA specialist meeting on decommissioning requirements in the design of nuclear facilities, Paris, France, 17-19 Mar 1980) | | | |
| | Paris, France; OECD (1980). | | | 7:224 |
| CONF-8003148- | (9. meeting of the theoretical physics department, Aussois, France, 17-21 Mar 1980) | | | |
| | *See* IPNO-TH-80-49 | | | 7:1525 |
| | *See* IPNO-TH-80-49 | | | 7:1526 |
| | *See* IPNO-TH-80-49 | | | 7:1527 |
| | *See* IPNO-TH-80-49 | | | 7:1528 |
| | *See* IPNO-TH-80-49 | | | 7:1529 |
| | *See* IPNO-TH-80-49 | | | 7:1530 |
| | *See* IPNO-TH-80-49 | | | 7:1550 |
| | *See* IPNO-TH-80-49 | | | 7:1551 |
| | *See* IPNO-TH-80-49 | | | 7:1552 |
| | *See* IPNO-TH-80-49 | | | 7:1569 |
| | *See* IPNO-TH-80-49 | | | 7:1591 |
| | *See* IPNO-TH-80-49 | | | 7:1635 |
| | *See* IPNO-TH-80-49 | | | 7:1636 |
| CONF-8003149- | (2. conference on petroleum geology of the continental shelf of North-West Europe, London, UK, 4 May-6 Mar 1980) | | | |
| | London, England; Heyden and Son Ltd. (1981). | | | 7:13 |
| CONF-800444- | (2. technical meeting on the nuclear transmutation of actinides, Ispra, Italy, 21-24 Apr 1980) | | | |
| | *See* EUR-6929 | | | 7:163 |
| | *See* EUR-6929 | | | 7:187 |
| CONF-8004121- | (European seminar on radioactive releases and their dispersion in the atmosphere following a hypothetical reactor accident, Riso, Denmark, 22-25 Apr 1980) | | | |
| (Vol.2) | NTIS (US Sales Only) | | | 7:995 |
| CONF-8004125- | (International school on nuclear structure, Alushta, USSR, 14-25 Apr 1980) | | | |
| | *See* JINR-D-4-80-385 | | | 7:1556 |
| | *See* JINR-D-4-80-385 | | | 7:1589 |
| | *See* JINR-D-4-80-385 | | | 7:1596 |
| | *See* JINR-D-4-80-385 | | | 7:1615 |
| | *See* JINR-D-4-80-385 | | | 7:1616 |
| | *See* JINR-D-4-80-385 | | | 7:1617 |
| CONF-8004154- | (Conference on gas chemistry in nuclear reactors and large industrial plant, Salford, UK, 21-24 Apr 1980) | | | |
| | London, England; Heyden (1980). | | | 7:842 |
| CONF-8004173- | (19. annual Kentucky industrial coal conference, Lexington, KY, USA, 30 Apr-1 May 1980) | | | |
| 11 | | DE82900069 | MN-90e | 7:905 |
| CONF-8004175- | (Seminar on equipment and techniques for testing properties of steels in liquid sodium, Ostravice, Czechoslovakia, 22-24 Apr 1980) | | | |
| | *See* INIS-mf-6423 | | | 7:396 |
| | *See* INIS-mf-6423 | | | 7:397 |
| | *See* INIS-mf-6423 | | | 7:398 |
| | *See* INIS-mf-6423 | | | 7:399 |
| | *See* INIS-mf-6423 | | | 7:400 |
| | *See* INIS-mf-6423 | | | 7:401 |
| | *See* INIS-mf-6423 | | | 7:402 |
| | *See* INIS-mf-6423 | | | 7:403 |
| | *See* INIS-mf-6423 | | | 7:404 |
| | *See* INIS-mf-6423 | | | 7:405 |
| | *See* INIS-mf-6423 | | | 7:547 |
| | *See* INIS-mf-6423 | | | 7:548 |
| | *See* INIS-mf-6423 | | | 7:549 |
| | *See* INIS-mf-6423 | | | 7:648 |
| | *See* INIS-mf-6423 | | | 7:649 |
| | *See* INIS-mf-6423 | | | 7:650 |
| | *See* INIS-mf-6423 | | | 7:651 |
| | *See* INIS-mf-6423 | | | 7:741 |
| CONF-8004176- | (5. ESA-PAC symposium on European rocket and balloon programmes and related research, Bournemouth, UK, 14-18 Apr 1980) | | | |
| | *See* ESA-SP-152 | | | 7:1373 |
| | *See* ESA-SP-152 | | | 7:1374 |
| | *See* ESA-SP-152 | | | 7:1375 |
| | *See* ESA-SP-152 | | | 7:1376 |
| | *See* ESA-SP-152 | | | 7:1377 |
| | *See* ESA-SP-152 | | | 7:1378 |
| | *See* ESA-SP-152 | | | 7:1379 |
| | *See* ESA-SP-152 | | | 7:1380 |
| | *See* ESA-SP-152 | | | 7:1381 |
| CONF-800527- | (International BHP symposium, Columbus, OH, USA, 7-9 May 1980) | | | |
| | Paris, France; OECD (1980). | | | 7:190 |
| CONF-8005163- | (IAEA specialists meeting on distributed systems for nuclear power plants, Chalk River, Canada, 14-16 May 1980) | | | |
| | *See* AECL-7056 | | | 7:244 |
| | *See* AECL-7056 | | | 7:274 |
| | *See* AECL-7056 | | | 7:276 |
| | *See* AECL-7056 | | | 7:443 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| | *See* AECL-7056 | | | 7:523 |
| | *See* AECL-7056 | | | 7:524 |
| | *See* AECL-7056 | | | 7:525 |
| | *See* AECL-7056 | | | 7:526 |
| | *See* AECL-7056 | | | 7:527 |
| | *See* AECL-7056 | | | 7:528 |
| | *See* AECL-7056 | | | 7:529 |
| | *See* AECL-7056 | | | 7:530 |
| | *See* AECL-7056 | | | 7:531 |
| | *See* AECL-7056 | | | 7:532 |
| | *See* AECL-7056 | | | 7:533 |
| | *See* AECL-7056 | | | 7:534 |
| | *See* AECL-7056 | | | 7:535 |
| | *See* AECL-7056 | | | 7:536 |
| | *See* AECL-7056 | | | 7:537 |
| | *See* AECL-7056 | | | 7:545 |
| | *See* AECL-7056 | | | 7:546 |
| **CONF-8005190-** | (Canadian Nuclear Association heat exchanger reliability seminar, Toronto, Canada, 1 May 1980) | | | |
| | *See* AECL-6885 | | | 7:442 |
| **CONF-800608-** | (Air Pollution Control Association annual meeting, Montreal, Canada, Jun 1980) | | | |
| 9 | Pittsburgh, PA; Air Pollution Control Association (1980). | | | 7:982 |
| 12 | Pittsburgh, PA; Air Pollution Control Association (1980). | | | 7:999 |
| (Vol.1) | Pittsburgh, PA; Air Pollution Control Association (1980). | | | 7:983 |
| **CONF-8008106-** | (8. Australian chemical engineering conference, Melbourne, Australia, 24-27 Aug 1980) | | | |
| | Melbourne, Australia; Institution of Engineers (1980). | | | 7:158 |
| **CONF-8008127-** | (4. National congress of the Australian Institute of Physics, Melbourne, Australia, 25-29 Aug 1980) | | | |
| | Melbourne, Australia; Australian Institute of Physics (1980). | | | 7:1276 |
| **CONF-8008130-** | (9. Australian ceramic conference, Sydney, Australia, 27-29 Aug 1980) | | | |
| | Sydney, Australia; Australian Ceramic Society (1980). | | | 7:709 |
| **CONF-8009181-** | (Specialists' meeting on pellet-cladding interaction in water reactors, Roskilde, Denmark, 22-26 Sep 1980) | | | |
| | *See* IWGFPT-8 | | | 7:277 |
| | *See* IWGFPT-8 | | | 7:278 |
| | *See* IWGFPT-8 | | | 7:279 |
| | *See* IWGFPT-8 | | | 7:303 |
| | *See* IWGFPT-8 | | | 7:304 |
| | *See* IWGFPT-8 | | | 7:305 |
| | *See* IWGFPT-8 | | | 7:306 |
| | *See* IWGFPT-8 | | | 7:489 |
| | *See* IWGFPT-8 | | | 7:490 |
| | *See* IWGFPT-8 | | | 7:491 |
| | *See* IWGFPT-8 | | | 7:492 |
| | *See* IWGFPT-8 | | | 7:493 |
| | *See* IWGFPT-8 | | | 7:494 |
| | *See* IWGFPT-8 | | | 7:495 |
| | *See* IWGFPT-8 | | | 7:496 |
| | *See* IWGFPT-8 | | | 7:497 |
| | *See* IWGFPT-8 | | | 7:498 |
| | *See* IWGFPT-8 | | | 7:499 |
| | *See* IWGFPT-8 | | | 7:500 |
| | *See* IWGFPT-8 | | | 7:501 |
| | *See* IWGFPT-8 | | | 7:502 |
| | *See* IWGFPT-8 | | | 7:503 |
| | *See* IWGFPT-8 | | | 7:504 |
| | *See* IWGFPT-8 | | | 7:505 |
| | *See* IWGFPT-8 | | | 7:554 |
| **CONF-8009191-** | (3. colloquium on fracture, London, UK, 8-10 Sep 1980) | | | |
| | Oxford, England; Pergamon Press (1980). | | | 7:677 |
| **CONF-8009210-** | (7. world congress of anaesthesiologits, Hamburg, F.R. Germany, 14-21 Sep 1980) | | | |
| (Absts.) | Amsterdam, Netherlands; Excerpta Medica (1980). | | | 7:1203 |
| **CONF-8010113-** | (Specialists meeting on nuclear data and benchmarks for reactor shielding, Paris, France, 27-29 Oct 1980) | | | |
| | Paris, France; OECD (1981). | | | 7:1642 |
| **CONF-8010215-** | (3. national conference on biomedical physics and engineering with international participation, Sofia, Bulgaria, 25-26 Oct 1980) | | | |
| (Absts.) | *See* INIS-mf-6304 | | | 7:1142 |
| **CONF-801103-** | (IEEE nuclear science symposium, Orlando, FL, USA, 5-7 Nov 1980) | | | |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 385-389(Feb 1981) | | | 7:914 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 244-248(Feb 1981) | | | 7:1001 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 249-254(Feb 1981) | | | 7:1007 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 226-230(Feb 1981) | | | 7:1052 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 81-89(Feb 1981) | | | 7:1086 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 50-54(Feb 1981) | | | 7:1087 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 99-103(Feb 1981) | | | 7:1118 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 346-350(Feb 1981) | | | 7:1708 |
| | IEEE Trans. Nucl. Sci., NS-28: No. 1, 375-379(Feb 1981) | | | 7:1709 |
| **CONF-801115-** | (6. international symposium on packaging and transporting radioactive material, Berlin, F.R. Germany, 10 Nov 1980) | | | |
| (Summ.) | *See* INIS-mf-6447 | | | 7:172 |

| *Report No.* | *Availability* | *Order No.* | *Distribution Category* | *Abstract No.* |
|---|---|---|---|---|
| (Summ.) | *See* INIS-mf-6447 | | | 7:173 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:174 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:175 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:176 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:177 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:178 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:179 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:180 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:181 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:182 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:243 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:297 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:406 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:612 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:702 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:853 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:854 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:855 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:856 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:857 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:858 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:859 |
| (Summ.) | *See* INIS-mf-6447 | | | 7:860 |
| **CONF-801124-** | (3. annual meeting of the Materials Research Society, Boston, MA, USA, 17-20 Nov 1980) | | | |
| (Pt.1) | New York, NY; Plenum Press (1981). | | | 7:188 |
| **CONF-801207-** | (GAMNI international symposium on numerical methods in engineering, Paris, France, 1-5 Dec 1980) | | | |
| (Vol.1) | Paris, France; Dunod (1980). | | | 7:571 |
| **CONF-801271-** | (3. symposium on nuclear chemistry, radiochemistry and radiation chemistry, Mexico City, Mexico, 8-10 Dec 1980) | | | |
| (Summ.) | *See* INIS-mf-6450 | | | 7:652 |
| **CONF-810266-** | (13. AINSE plasma physics conference, Lucas Heights, Australia, 9-11 Feb 1981) | | | |
| (Absts.) | *See* INIS-mf-6424 | | | 7:1672 |
| (Absts.) | *See* INIS-mf-6424 | | | 7:1673 |
| (Absts.) | *See* INIS-mf-6424 | | | 7:1674 |
| **CSIRO-** | | | | |
| 4 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1978). | | | 7:5 |
| 16 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). | | | 7:7 |
| 18 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). | | | 7:8 |
| 21 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1981). | | | 7:6 |
| 24 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). | | | 7:9 |
| 26 | Mount Waverley, Australia; Commonwealth Scientific and Industrial Research Organization (1980). | | | 7:10 |
| **DOE/TIC-** | | | | |
| 1030778 | New York, NY; Academic Press, Inc. (1980). | | | 7:260 |
| **ESA-SP-** | | | | |
| 152 | NTIS (US Sales Only) | | | 7:1373 |
| 152 | NTIS (US Sales Only) | | | 7:1374 |
| 152 | NTIS (US Sales Only) | | | 7:1375 |
| 152 | NTIS (US Sales Only) | | | 7:1376 |
| 152 | NTIS (US Sales Only) | | | 7:1377 |
| 152 | NTIS (US Sales Only) | | | 7:1378 |
| 152 | NTIS (US Sales Only) | | | 7:1379 |
| 152 | NTIS (US Sales Only) | | | 7:1380 |
| 152 | NTIS (US Sales Only) | | | 7:1381 |
| **EUR-** | | | | |
| 6629 | NTIS (US Sales Only) | | | 7:236 |
| 6813(Vol.1) | NTIS (US Sales Only) | | | 7:289 |
| 6813(Vol.1) | NTIS (US Sales Only) | | | 7:290 |
| 6813(Vol.1) | NTIS (US Sales Only) | | | 7:291 |
| 6813(Vol.1) | NTIS (US Sales Only) | | | 7:292 |
| 6813(Vol.1) | NTIS (US Sales Only) | | | 7:444 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:237 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:293 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:294 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:295 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:296 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:395 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:433 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:434 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:435 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:436 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:437 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:438 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:540 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:925 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:926 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:927 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:928 |

| *Report No.* | *Availability* | *Order No.* | *Distribution Category* | *Abstract No.* |
|---|---|---|---|---|
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:929 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:930 |
| 6813(Vol.2) | NTIS (US Sales Only) | | | 7:1638 |
| 6929 | NTIS (US Sales Only) | | | 7:163 |
| 6929 | NTIS (US Sales Only) | | | 7:187 |
| **GPO-** | | | | |
| 56-735 | | | MN-00 | 7:273 |
| 65-855 | | | MN-00 | 7:627 |
| **IA-** | | | | |
| 1356 | NTIS (US Sales Only) | | | 7:908 |
| 1356 | NTIS (US Sales Only) | | | 7:931 |
| 1356 | NTIS (US Sales Only) | | | 7:932 |
| 1356 | NTIS (US Sales Only) | | | 7:974 |
| 1356 | NTIS (US Sales Only) | | | 7:979 |
| 1356 | NTIS (US Sales Only) | | | 7:981 |
| 1356 | NTIS (US Sales Only) | | | 7:986 |
| **IAEA-SMR-** | | | | |
| 43 | NTIS (US Sales Only) | | | 7:1604 |
| 43 | NTIS (US Sales Only) | | | 7:1605 |
| 43 | NTIS (US Sales Only) | | | 7:1606 |
| 43 | NTIS (US Sales Only) | | | 7:1607 |
| 43 | NTIS (US Sales Only) | | | 7:1608 |
| 43 | NTIS (US Sales Only) | | | 7:1609 |
| 43 | NTIS (US Sales Only) | | | 7:1610 |
| 43 | NTIS (US Sales Only) | | | 7:1611 |
| 43 | NTIS (US Sales Only) | | | 7:1612 |
| 43 | NTIS (US Sales Only) | | | 7:1613 |
| 43 | NTIS (US Sales Only) | | | 7:1614 |
| **IAEA-TECDOC-** | | | | |
| 229 | NTIS (US Sales Only) | | | 7:933 |
| 229 | NTIS (US Sales Only) | | | 7:1006 |
| 229 | NTIS (US Sales Only) | | | 7:1036 |
| 229 | NTIS (US Sales Only) | | | 7:1037 |
| 229 | NTIS (US Sales Only) | | | 7:1038 |
| 229 | NTIS (US Sales Only) | | | 7:1039 |
| 229 | NTIS (US Sales Only) | | | 7:1040 |
| 229 | NTIS (US Sales Only) | | | 7:1041 |
| 229 | NTIS (US Sales Only) | | | 7:1042 |
| 229 | NTIS (US Sales Only) | | | 7:1043 |
| 229 | NTIS (US Sales Only) | | | 7:1044 |
| 236 | NTIS (US Sales Only) | | | 7:1122 |
| 236 | NTIS (US Sales Only) | | | 7:1123 |
| 236 | NTIS (US Sales Only) | | | 7:1124 |
| 236 | NTIS (US Sales Only) | | | 7:1125 |
| 236 | NTIS (US Sales Only) | | | 7:1126 |
| 236 | NTIS (US Sales Only) | | | 7:1127 |
| 236 | NTIS (US Sales Only) | | | 7:1128 |
| 236 | NTIS (US Sales Only) | | | 7:1129 |
| 236 | NTIS (US Sales Only) | | | 7:1130 |
| 236 | NTIS (US Sales Only) | | | 7:1131 |
| 236 | NTIS (US Sales Only) | | | 7:1132 |
| **INDC(CCP)-** | | | | |
| 135/ LN | NTIS (US Sales Only) | | | 7:1597 |
| 135/ LN | NTIS (US Sales Only) | | | 7:1598 |
| 135/ LN | NTIS (US Sales Only) | | | 7:1599 |
| 135/ LN | NTIS (US Sales Only) | | | 7:1600 |
| 150/ LJH | NTIS (US Sales Only) | | | 7:1601 |
| 150/ LJH | NTIS (US Sales Only) | | | 7:1602 |
| **INIS-mf-** | | | | |
| 5673 | NTIS (US Sales Only) | | | 7:836 |
| 5673 | NTIS (US Sales Only) | | | 7:1137 |
| 5673 | NTIS (US Sales Only) | | | 7:1138 |
| 5673 | NTIS (US Sales Only) | | | 7:1139 |
| 5673 | NTIS (US Sales Only) | | | 7:1140 |
| 6050 | NTIS MF A01 | | | 7:1141 |
| 6084 | NTIS (US Sales Only) | | | 7:1441 |
| 6084 | NTIS (US Sales Only) | | | 7:1646 |
| 6084 | NTIS (US Sales Only) | | | 7:1647 |
| 6084 | NTIS (US Sales Only) | | | 7:1648 |
| 6290 | NTIS (US Sales Only) | | | 7:1277 |
| 6290 | NTIS (US Sales Only) | | | 7:1278 |
| 6290 | NTIS (US Sales Only) | | | 7:1279 |
| 6290 | NTIS (US Sales Only) | | | 7:1382 |
| 6290 | NTIS (US Sales Only) | | | 7:1383 |
| 6290 | NTIS (US Sales Only) | | | 7:1384 |
| 6295 | NTIS (US Sales Only) | | | 7:909 |
| 6304 | NTIS (US Sales Only) | | | 7:1142 |
| 6385 | NTIS (US Sales Only) | | | 7:1280 |
| 6385 | NTIS (US Sales Only) | | | 7:1281 |
| 6385 | NTIS (US Sales Only) | | | 7:1282 |
| 6385 | NTIS (US Sales Only) | | | 7:1283 |
| 6385 | NTIS (US Sales Only) | | | 7:1284 |
| 6385 | NTIS (US Sales Only) | | | 7:1285 |
| 6385 | NTIS (US Sales Only) | | | 7:1286 |
| 6419 | NTIS (US Sales Only) | | | 7:1053 |
| 6419 | NTIS (US Sales Only) | | | 7:1054 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| 6419 | NTIS (US Sales Only) | | | 7:1055 |
| 6419 | NTIS (US Sales Only) | | | 7:1056 |
| 6419 | NTIS (US Sales Only) | | | 7:1057 |
| 6419 | NTIS (US Sales Only) | | | 7:1058 |
| 6419 | NTIS (US Sales Only) | | | 7:1059 |
| 6419 | NTIS (US Sales Only) | | | 7:1060 |
| 6419 | NTIS (US Sales Only) | | | 7:1061 |
| 6419 | NTIS (US Sales Only) | | | 7:1062 |
| 6419 | NTIS (US Sales Only) | | | 7:1063 |
| 6419 | NTIS (US Sales Only) | | | 7:1064 |
| 6419 | NTIS (US Sales Only) | | | 7:1065 |
| 6419 | NTIS (US Sales Only) | | | 7:1066 |
| 6419 | NTIS (US Sales Only) | | | 7:1067 |
| 6419 | NTIS (US Sales Only) | | | 7:1109 |
| 6419 | NTIS (US Sales Only) | | | 7:1110 |
| 6419 | NTIS (US Sales Only) | | | 7:1111 |
| 6419 | NTIS (US Sales Only) | | | 7:1112 |
| 6419 | NTIS (US Sales Only) | | | 7:1243 |
| 6420 | NTIS (US Sales Only) | | | 7:1133 |
| 6420 | NTIS (US Sales Only) | | | 7:1134 |
| 6420 | NTIS (US Sales Only) | | | 7:1135 |
| 6421 | NTIS (US Sales Only) | | | 7:1113 |
| 6421 | NTIS (US Sales Only) | | | 7:1244 |
| 6422 | NTIS (US Sales Only) | | | 7:2 |
| 6422 | NTIS (US Sales Only) | | | 7:3 |
| 6422 | NTIS (US Sales Only) | | | 7:11 |
| 6422 | NTIS (US Sales Only) | | | 7:12 |
| 6422 | NTIS (US Sales Only) | | | 7:58 |
| 6422 | NTIS (US Sales Only) | | | 7:249 |
| 6422 | NTIS (US Sales Only) | | | 7:972 |
| 6422 | NTIS (US Sales Only) | | | 7:973 |
| 6422 | NTIS (US Sales Only) | | | 7:978 |
| 6422 | NTIS (US Sales Only) | | | 7:1032 |
| 6422 | NTIS (US Sales Only) | | | 7:1033 |
| 6422 | NTIS (US Sales Only) | | | 7:1265 |
| 6422 | NTIS (US Sales Only) | | | 7:1266 |
| 6422 | NTIS (US Sales Only) | | | 7:1267 |
| 6422 | NTIS (US Sales Only) | | | 7:1268 |
| 6423 | NTIS (US Sales Only) | | | 7:396 |
| 6423 | NTIS (US Sales Only) | | | 7:397 |
| 6423 | NTIS (US Sales Only) | | | 7:398 |
| 6423 | NTIS (US Sales Only) | | | 7:399 |
| 6423 | NTIS (US Sales Only) | | | 7:400 |
| 6423 | NTIS (US Sales Only) | | | 7:401 |
| 6423 | NTIS (US Sales Only) | | | 7:402 |
| 6423 | NTIS (US Sales Only) | | | 7:403 |
| 6423 | NTIS (US Sales Only) | | | 7:404 |
| 6423 | NTIS (US Sales Only) | | | 7:405 |
| 6423 | NTIS (US Sales Only) | | | 7:547 |
| 6423 | NTIS (US Sales Only) | | | 7:548 |
| 6423 | NTIS (US Sales Only) | | | 7:549 |
| 6423 | NTIS (US Sales Only) | | | 7:648 |
| 6423 | NTIS (US Sales Only) | | | 7:649 |
| 6423 | NTIS (US Sales Only) | | | 7:650 |
| 6423 | NTIS (US Sales Only) | | | 7:651 |
| 6423 | NTIS (US Sales Only) | | | 7:741 |
| 6424 | NTIS (US Sales Only) | | | 7:1672 |
| 6424 | NTIS (US Sales Only) | | | 7:1673 |
| 6424 | NTIS (US Sales Only) | | | 7:1674 |
| 6447 | NTIS (US Sales Only) | | | 7:172 |
| 6447 | NTIS (US Sales Only) | | | 7:173 |
| 6447 | NTIS (US Sales Only) | | | 7:174 |
| 6447 | NTIS (US Sales Only) | | | 7:175 |
| 6447 | NTIS (US Sales Only) | | | 7:176 |
| 6447 | NTIS (US Sales Only) | | | 7:177 |
| 6447 | NTIS (US Sales Only) | | | 7:178 |
| 6447 | NTIS (US Sales Only) | | | 7:179 |
| 6447 | NTIS (US Sales Only) | | | 7:180 |
| 6447 | NTIS (US Sales Only) | | | 7:181 |
| 6447 | NTIS (US Sales Only) | | | 7:182 |
| 6447 | NTIS (US Sales Only) | | | 7:243 |
| 6447 | NTIS (US Sales Only) | | | 7:297 |
| 6447 | NTIS (US Sales Only) | | | 7:406 |
| 6447 | NTIS (US Sales Only) | | | 7:612 |
| 6447 | NTIS (US Sales Only) | | | 7:702 |
| 6447 | NTIS (US Sales Only) | | | 7:853 |
| 6447 | NTIS (US Sales Only) | | | 7:854 |
| 6447 | NTIS (US Sales Only) | | | 7:855 |
| 6447 | NTIS (US Sales Only) | | | 7:856 |
| 6447 | NTIS (US Sales Only) | | | 7:857 |
| 6447 | NTIS (US Sales Only) | | | 7:858 |
| 6447 | NTIS (US Sales Only) | | | 7:859 |
| 6447 | NTIS (US Sales Only) | | | 7:860 |
| 6449 | NTIS (US Sales Only) | | | 7:712 |
| 6449 | NTIS (US Sales Only) | | | 7:713 |
| 6449 | NTIS (US Sales Only) | | | 7:1649 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| 6450 | NTIS (US Sales Only) | | | 7:652 |
| 6479 | NTIS (US Sales Only) | | | 7:1553 |
| 6479 | NTIS (US Sales Only) | | | 7:1555 |
| 6479 | NTIS (US Sales Only) | | | 7:1661 |
| 6531 | NTIS (US Sales Only) | | | 7:934 |
| 6531 | NTIS (US Sales Only) | | | 7:1084 |
| 6531 | NTIS (US Sales Only) | | | 7:1085 |
| 6531 | NTIS (US Sales Only) | | | 7:1143 |
| 6531 | NTIS (US Sales Only) | | | 7:1144 |
| 6531 | NTIS (US Sales Only) | | | 7:1145 |
| 6531 | NTIS (US Sales Only) | | | 7:1146 |
| 6531 | NTIS (US Sales Only) | | | 7:1147 |
| 6531 | NTIS (US Sales Only) | | | 7:1148 |
| 6531 | NTIS (US Sales Only) | | | 7:1149 |
| 6531 | NTIS (US Sales Only) | | | 7:1150 |
| 6531 | NTIS (US Sales Only) | | | 7:1151 |
| 6531 | NTIS (US Sales Only) | | | 7:1152 |
| 6531 | NTIS (US Sales Only) | | | 7:1153 |
| 6531 | NTIS (US Sales Only) | | | 7:1154 |
| 6531 | NTIS (US Sales Only) | | | 7:1155 |
| 6531 | NTIS (US Sales Only) | | | 7:1156 |
| 6531 | NTIS (US Sales Only) | | | 7:1157 |
| 6531 | NTIS (US Sales Only) | | | 7:1158 |
| 6531 | NTIS (US Sales Only) | | | 7:1159 |
| 6531 | NTIS (US Sales Only) | | | 7:1160 |
| 6531 | NTIS (US Sales Only) | | | 7:1161 |
| 6531 | NTIS (US Sales Only) | | | 7:1162 |
| 6531 | NTIS (US Sales Only) | | | 7:1163 |
| 6531 | NTIS (US Sales Only) | | | 7:1164 |
| 6531 | NTIS (US Sales Only) | | | 7:1165 |
| 6531 | NTIS (US Sales Only) | | | 7:1166 |
| 6531 | NTIS (US Sales Only) | | | 7:1167 |
| 6531 | NTIS (US Sales Only) | | | 7:1168 |
| 6531 | NTIS (US Sales Only) | | | 7:1169 |
| 6531 | NTIS (US Sales Only) | | | 7:1170 |
| 6531 | NTIS (US Sales Only) | | | 7:1171 |
| 6531 | NTIS (US Sales Only) | | | 7:1245 |
| 6531 | NTIS (US Sales Only) | | | 7:1246 |
| **INP-** | | | | |
| 1014/ PL | NTIS (US Sales Only) | DE81700032 | | 7:1592 |
| **IPNO-TH-** | | | | |
| 80-49 | NTIS (US Sales Only) | | | 7:1525 |
| 80-49 | NTIS (US Sales Only) | | | 7:1526 |
| 80-49 | NTIS (US Sales Only) | | | 7:1527 |
| 80-49 | NTIS (US Sales Only) | | | 7:1528 |
| 80-49 | NTIS (US Sales Only) | | | 7:1529 |
| 80-49 | NTIS (US Sales Only) | | | 7:1530 |
| 80-49 | NTIS (US Sales Only) | | | 7:1550 |
| 80-49 | NTIS (US Sales Only) | | | 7:1551 |
| 80-49 | NTIS (US Sales Only) | | | 7:1552 |
| 80-49 | NTIS (US Sales Only) | | | 7:1569 |
| 80-49 | NTIS (US Sales Only) | | | 7:1591 |
| 80-49 | NTIS (US Sales Only) | | | 7:1635 |
| 80-49 | NTIS (US Sales Only) | | | 7:1636 |
| **ITEF-** | | | | |
| 129(1979) | NTIS (US Sales Only) | | | 7:1570 |
| **IWGFPT-** | | | | |
| 7 | NTIS (US Sales Only) | | | 7:298 |
| 7 | NTIS (US Sales Only) | | | 7:299 |
| 7 | NTIS (US Sales Only) | | | 7:300 |
| 7 | NTIS (US Sales Only) | | | 7:301 |
| 7 | NTIS (US Sales Only) | | | 7:302 |
| 7 | NTIS (US Sales Only) | | | 7:471 |
| 7 | NTIS (US Sales Only) | | | 7:472 |
| 7 | NTIS (US Sales Only) | | | 7:473 |
| 7 | NTIS (US Sales Only) | | | 7:474 |
| 7 | NTIS (US Sales Only) | | | 7:475 |
| 7 | NTIS (US Sales Only) | | | 7:476 |
| 7 | NTIS (US Sales Only) | | | 7:477 |
| 7 | NTIS (US Sales Only) | | | 7:478 |
| 7 | NTIS (US Sales Only) | | | 7:479 |
| 7 | NTIS (US Sales Only) | | | 7:480 |
| 7 | NTIS (US Sales Only) | | | 7:481 |
| 7 | NTIS (US Sales Only) | | | 7:482 |
| 7 | NTIS (US Sales Only) | | | 7:483 |
| 7 | NTIS (US Sales Only) | | | 7:484 |
| 7 | NTIS (US Sales Only) | | | 7:485 |
| 7 | NTIS (US Sales Only) | | | 7:486 |
| 7 | NTIS (US Sales Only) | | | 7:487 |
| 7 | NTIS (US Sales Only) | | | 7:488 |
| 7 | NTIS (US Sales Only) | | | 7:550 |
| 7 | NTIS (US Sales Only) | | | 7:551 |
| 7 | NTIS (US Sales Only) | | | 7:552 |
| 7 | NTIS (US Sales Only) | | | 7:553 |
| 7 | NTIS (US Sales Only) | | | 7:653 |
| 7 | NTIS (US Sales Only) | | | 7:654 |

| Report No. | Availability | Order No. | Distribution Category | Abstract No. |
|---|---|---|---|---|
| 7 | NTIS (US Sales Only) | | | 7:703 |
| 8 | NTIS (US Sales Only) | | | 7:277 |
| 8 | NTIS (US Sales Only) | | | 7:278 |
| 8 | NTIS (US Sales Only) | | | 7:279 |
| 8 | NTIS (US Sales Only) | | | 7:303 |
| 8 | NTIS (US Sales Only) | | | 7:304 |
| 8 | NTIS (US Sales Only) | | | 7:305 |
| 8 | NTIS (US Sales Only) | | | 7:306 |
| 8 | NTIS (US Sales Only) | | | 7:489 |
| 8 | NTIS (US Sales Only) | | | 7:490 |
| 8 | NTIS (US Sales Only) | | | 7:491 |
| 8 | NTIS (US Sales Only) | | | 7:492 |
| 8 | NTIS (US Sales Only) | | | 7:493 |
| 8 | NTIS (US Sales Only) | | | 7:494 |
| 8 | NTIS (US Sales Only) | | | 7:495 |
| 8 | NTIS (US Sales Only) | | | 7:496 |
| 8 | NTIS (US Sales Only) | | | 7:497 |
| 8 | NTIS (US Sales Only) | | | 7:498 |
| 8 | NTIS (US Sales Only) | | | 7:499 |
| 8 | NTIS (US Sales Only) | | | 7:500 |
| 8 | NTIS (US Sales Only) | | | 7:501 |
| 8 | NTIS (US Sales Only) | | | 7:502 |
| 8 | NTIS (US Sales Only) | | | 7:503 |
| 8 | NTIS (US Sales Only) | | | 7:504 |
| 8 | NTIS (US Sales Only) | | | 7:505 |
| 8 | NTIS (US Sales Only) | | | 7:554 |
| **IWGHTR-** | | | | |
| 2 | NTIS (US Sales Only) | | | 7:332 |
| 2 | NTIS (US Sales Only) | | | 7:333 |
| 2 | NTIS (US Sales Only) | | | 7:334 |
| 2 | NTIS (US Sales Only) | | | 7:335 |
| 2 | NTIS (US Sales Only) | | | 7:336 |
| 2 | NTIS (US Sales Only) | | | 7:337 |
| 2 | NTIS (US Sales Only) | | | 7:338 |
| 2 | NTIS (US Sales Only) | | | 7:339 |
| 2 | NTIS (US Sales Only) | | | 7:445 |
| 2 | NTIS (US Sales Only) | | | 7:446 |
| 2 | NTIS (US Sales Only) | | | 7:447 |
| 2 | NTIS (US Sales Only) | | | 7:448 |
| 2 | NTIS (US Sales Only) | | | 7:449 |
| 2 | NTIS (US Sales Only) | | | 7:555 |
| **JINR-** | | | | |
| D-4-80-385 | NTIS (US Sales Only) | | | 7:1589 |
| D-4-80-385 | NTIS (US Sales Only) | | | 7:1615 |
| **JINR-D-** | | | | |
| 2-11707 | NTIS (US Sales Only) | | | 7:1481 |
| 4-80-385 | NTIS (US Sales Only) | | | 7:1556 |
| 4-80-385 | NTIS (US Sales Only) | | | 7:1596 |
| 4-80-385 | NTIS (US Sales Only) | | | 7:1616 |
| 4-80-385 | NTIS (US Sales Only) | | | 7:1617 |
| 12831 | NTIS (US Sales Only) | | | 7:1287 |
| **KFTI-** | | | | |
| 78-25 | NTIS (US Sales Only) | | | 7:655 |
| 78-64 | NTIS (US Sales Only) | | | 7:541 |
| 79-40 | NTIS (US Sales Only) | | | 7:742 |
| 79-40 | NTIS (US Sales Only) | | | 7:743 |
| 79-40 | NTIS (US Sales Only) | | | 7:935 |
| 79-40 | NTIS (US Sales Only) | | | 7:1584 |
| 79-40 | NTIS (US Sales Only) | | | 7:1587 |
| 79-40 | NTIS (US Sales Only) | | | 7:1618 |
| 79-40 | NTIS (US Sales Only) | | | 7:1619 |
| 79-40 | NTIS (US Sales Only) | | | 7:1620 |
| 79-48 | NTIS (US Sales Only) | | | 7:1558 |
| 79-48 | NTIS (US Sales Only) | | | 7:1559 |
| 79-48 | NTIS (US Sales Only) | | | 7:1560 |
| 79-48 | NTIS (US Sales Only) | | | 7:1561 |
| 79-48 | NTIS (US Sales Only) | | | 7:1562 |
| 79-48 | NTIS (US Sales Only) | | | 7:1563 |
| 79-48 | NTIS (US Sales Only) | | | 7:1564 |
| 79-48 | NTIS (US Sales Only) | | | 7:1565 |
| 79-48 | NTIS (US Sales Only) | | | 7:1566 |
| 79-48 | NTIS (US Sales Only) | | | 7:1571 |
| 79-48 | NTIS (US Sales Only) | | | 7:1572 |
| 79-48 | NTIS (US Sales Only) | | | 7:1573 |
| 79-48 | NTIS (US Sales Only) | | | 7:1621 |
| 79-48 | NTIS (US Sales Only) | | | 7:1622 |
| 79-48 | NTIS (US Sales Only) | | | 7:1623 |
| 79-57 | NTIS (US Sales Only) | | | 7:1640 |
| 79-65 | NTIS (US Sales Only) | | | 7:247 |
| 79-65 | NTIS (US Sales Only) | | | 7:450 |
| 79-65 | NTIS (US Sales Only) | | | 7:656 |
| 79-65 | NTIS (US Sales Only) | | | 7:1641 |
| 79-65 | NTIS (US Sales Only) | | | 7:1651 |
| 80-6 | NTIS (US Sales Only) | | | 7:1482 |
| 80-6 | NTIS (US Sales Only) | | | 7:1500 |
| 80-6 | NTIS (US Sales Only) | | | 7:1574 |

| *Report No.* | *Availability* | *Order No.* | *Distribution Category* | *Abstract No.* |
|---|---|---|---|---|
| 80-6 | NTIS (US Sales Only) | | | 7:1575 |
| 80-6 | NTIS (US Sales Only) | | | 7:1576 |
| 80-6 | NTIS (US Sales Only) | | | 7:1577 |
| 80-6 | NTIS (US Sales Only) | | | 7:1578 |
| **KURRI-TR-** | | | | |
| 179 | NTIS (US Sales Only) | | | 7:280 |
| 179 | NTIS (US Sales Only) | | | 7:987 |
| 179 | NTIS (US Sales Only) | | | 7:988 |
| 190 | NTIS (US Sales Only) | | | 7:913 |
| 190 | NTIS (US Sales Only) | | | 7:936 |
| 190 | NTIS (US Sales Only) | | | 7:937 |
| 190 | NTIS (US Sales Only) | | | 7:938 |
| 190 | NTIS (US Sales Only) | | | 7:939 |
| 190 | NTIS (US Sales Only) | | | 7:940 |
| 192 | NTIS (US Sales Only) | | | 7:542 |
| 192 | NTIS (US Sales Only) | | | 7:543 |
| **NASA-CASE-LEW-** | | | | |
| 12918-1 | | | MN-00 | 7:606 |
| **NASA-CASE-MFS-** | | | | |
| 23999-1 | | | MN-00 | 7:259 |
| **NP-** | | | | |
| 2900461 | | DE82900461 | ND-13 | 7:1705 |
| 2900749 | | DE82900749 | MN-11 | 7:980 |
| 2900750 | | DE82900750 | MN-70 | 7:226 |
| 2900890 | | DE82900890 | MN-70 | 7:613 |
| 2900891 | | DE82900891 | MN-70 | 7:242 |
| 2900892 | | DE82900892 | MN-70 | 7:185 |
| 2900893 | | DE82900893 | MN-70 | 7:189 |
| 2900894 | | DE82900894 | MN-70 | 7:241 |
| **NYSERDA-** | | | | |
| 81-6 | | DE81904186 | MN-95e | 7:638 |
| **OUP-** | | | | |
| 81-09 | NTIS (US Sales Only) | | | 7:1588 |
| 81-09 | NTIS (US Sales Only) | | | 7:1593 |
| 81-09 | NTIS (US Sales Only) | | | 7:1594 |
| 81-09 | NTIS (US Sales Only) | | | 7:1595 |
| 81-09 | NTIS (US Sales Only) | | | 7:1637 |
| **P-** | | | | |
| 300-80-033 | | DE82900406 | MN-98F | 7:628 |
| 800-81-003 | | DE82900592 | MN-66e | 7:271 |
| 800-81-005 | | DE82900595 | MN-66 | 7:272 |
| **PUBL-** | | | | |
| 96-145 | | | MN-00 | 7:629 |
| **RL-** | | | | |
| 80-043 | NTIS (US Sales Only) | | | 7:941 |
| **TRI-** | | | | |
| 79-1 | NTIS (US Sales Only) | | | 7:1483 |
| 79-1 | NTIS (US Sales Only) | | | 7:1484 |
| 79-1 | NTIS (US Sales Only) | | | 7:1485 |
| 79-1 | NTIS (US Sales Only) | | | 7:1486 |
| 79-1 | NTIS (US Sales Only) | | | 7:1501 |
| 79-1 | NTIS (US Sales Only) | | | 7:1502 |
| 79-1 | NTIS (US Sales Only) | | | 7:1503 |
| 79-1 | NTIS (US Sales Only) | | | 7:1504 |
| 79-1 | NTIS (US Sales Only) | | | 7:1505 |
| 79-1 | NTIS (US Sales Only) | | | 7:1531 |
| 79-1 | NTIS (US Sales Only) | | | 7:1579 |
| 79-1 | NTIS (US Sales Only) | | | 7:1580 |
| 79-1 | NTIS (US Sales Only) | | | 7:1581 |
| 79-1 | NTIS (US Sales Only) | | | 7:1582 |
| 79-1 | NTIS (US Sales Only) | | | 7:1624 |
| 79-1 | NTIS (US Sales Only) | | | 7:1625 |
| 79-1 | NTIS (US Sales Only) | | | 7:1626 |
| **USBM-J-** | | | | |
| 0318093 | *See* BCR-L-1245 | DE82900425 | MN-88 | 7:4 |
| **ZfI-Mitt-** | | | | |
| 32 | NTIS (US Sales Only) | | | 7:744 |
| **ZfK-** | | | | |
| 410 | NTIS (US Sales Only) | | | 7:942 |
| 410 | NTIS (US Sales Only) | | | 7:1557 |
| 410 | NTIS (US Sales Only) | | | 7:1585 |
| 410 | NTIS (US Sales Only) | | | 7:1706 |
| 410 | NTIS (US Sales Only) | | | 7:1707 |

## Abbreviations Used in Availability Column

**EM** Available in aperture card format only. Inquiries regarding the availability of these items should be addressed to USDOE-TIC, P. O. Box 62, Oak Ridge, Tennessee, 37830.

**ETEC** Available *only to requesters within the United States* from the Energy Technology Engineering Center, P. O. Box 1449, Canoga Park, California 91304.

**GJO** Available from DOE Grand Junction Office, P. O. Box 2567, Grand Junction, Colorado 81501.

**GPO** For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

**NSO** Available *only to requesters within the United States* from the Nuclear Standards Office, Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, Tennessee 37830.

**NTIS** For sale by the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161. Price given is the domestic price for paper copy; prices for foreign purchasers are in most instances twice the domestic price.

**TIC** Available from the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

## NTIS NORTH AMERICAN PRICE CODES

Most NTIS products and services are now announced by price codes and, therefore, without specific prices in NTIS journals, newsletters and indexes.

The current dollar equivalent for each code is shown in the schedule below. Orders must list the accession number(s) and be accompanied by the total dollar amount from the current schedule.

### NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.

| | | |
|---|---|---|
| A01 $4.00 | E01 $5.50 | T01 $110.00 |
| A02 6.00 | E02 6.50 | T02 125.00 |
| A03 7.50 | E03 8.50 | T03 210.00 |
| A04 9.00 | E04 10.50 | T04 300.00 |
| A05 10.50 | E05 12.50 | T05 360.00 |
| A06 12.00 | E06 14.50 | T06 420.00 |
| A07 13.50 | E07 16.50 | T07 480.00 |
| A08 15.00 | E08 18.50 | T08 540.00 |
| A09 16.50 | E09 20.50 | T09 600.00 |
| A10 18.00 | E10 22.50 | T10 660.00 |
| A11 19.50 | E11 24.50 | T11 720.00 |
| A12 21.00 | E12 27.50 | T12 780.00 |
| A13 22.50 | E13 30.50 | T13 840.00 |
| A14 24.00 | E14 33.50 | T14 900.00 |
| A15 25.50 | E15 36.50 | T15 960.00 |
| A16 27.00 | E16 39.50 | T16 1,020.00 |
| A17 28.50 | E17 42.50 | T17 1,080.00 |
| A18 30.00 | E18 45.50 | T18 1,140.00 |
| A19 31.50 | E19 50.50 | T19 1,200.00 |
| A20 33.00 | E20 60.50 | T99 * |
| A21 34.50 | E99 * | |
| A22 36.00 | N01 30.00 | |
| A23 37.50 | E02 50.00 | |
| A24 39.00 | | |
| A25 40.50 | | |
| A99 * | | |

*Contact NTIS for price quote

PRICES EFFECTIVE JANUARY 1, 1982

**U.S. DEPARTMENT OF COMMERCE**
**National Technical Information Service**
5285 Port Royal Road
Springfield, Virginia 22161

☆ U.S. GOVERNMENT PRINTING OFFICE: 1982-546-064:19

Cut out appropriate form and mail in a stamped envelope to the address indicated.

## *Change of Address Form*

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

**PLEASE PRINT OR TYPE**

(or) COUNTRY

Mail this form to:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here.

## *Subscription Order Form*

**SUBSCRIPTION ORDER FORM**

**ENTER MY SUBSCRIPTION TO:**

**@ $ Domestic; @ $ Foreign.**

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

**PLEASE PRINT OR TYPE**

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No. .....

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

# REPORT COLLECTIONS

The libraries listed below purchase and maintain microfiche collections of DOE and foreign reports. Most of these libraries have microfiche reader-printers or other photocopy facilities with which to reproduce enlarged copies from microfiche. Charges for reproduction services vary.

## United States

**ALABAMA**
Auburn, Auburn University
**ARIZONA**
Tucson, University of Arizona
**CALIFORNIA**
Davis, University of California
Los Angeles, University of California
Santa Barbara, University of California
**COLORADO**
Boulder, University of Colorado
**DISTRICT OF COLUMBIA**
Washington, Library of Congress
**FLORIDA**
Gainesville, University of Florida
**GEORGIA**
Atlanta, Georgia Institute of Technology
**HAWAII**
Honolulu, University of Hawaii
**IDAHO**
Pocatello, Idaho State University
**ILLINOIS**
Urbana, University of Illinois
**INDIANA**
Lafayette, Purdue University
**IOWA**
Ames, Iowa State University
**KANSAS**
Manhattan, Kansas State University
**KENTUCKY**
Lexington, University of Kentucky
**MARYLAND**
Baltimore, Johns Hopkins University
College Park, University of Maryland
**MASSACHUSETTS**
Cambridge, Massachusetts Institute of Technology
Worcester, Worcester Polytechnic Institute
**MICHIGAN**
Ann Arbor, University of Michigan
**MISSISSIPPI**
Mississippi State, Mississippi State University
**MISSOURI**
Columbia, University of Missouri
Kansas City, Linda Hall Library
**NEBRASKA**
Lincoln, University of Nebraska
**NEW JERSEY**
Princeton, Princeton University
**NEW MEXICO**
Albuquerque, University of New Mexico
**NEW YORK**
Albany, New York State Library
Albany, State University at Albany
Ithaca, Cornell University
New York, Columbia University
Rochester, University of Rochester
Syracuse, Syracuse University
**NORTH CAROLINA**
Raleigh, North Carolina State University
**OHIO**
Cincinnati, University of Cincinnati
Cleveland, Cleveland Public Library
Toledo, University of Toledo
**OKLAHOMA**
Norman, University of Oklahoma
**PENNSYLVANIA**
Pittsburgh, Carnegie Library
**PUERTO RICO**
San Juan, University of Puerto Rico
**SOUTH CAROLINA**
Columbia, University of South Carolina
**TEXAS**
Austin, University of Texas
College Station, Texas A & M University
Houston, Rice University
**UTAH**
Salt Lake City, University of Utah
**VIRGINIA**
Charlottesville, University of Virginia
**WASHINGTON**
Pullman, Washington State University
Seattle, University of Washington
**WEST VIRGINIA**
Morgantown, West Virginia University
**WISCONSIN**
Madison, University of Wisconsin

## International

**EUROPEAN ATOMIC ENERGY COMMUNITY (EURATOM)**
Brussels, Belgium
Ispra, Varese, Italy, Cetis Library
**INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)**
Vienna, Austria
**OECD NUCLEAR ENERGY AGENCY (NEA)**
British Library Lending Division
Boston Spa, Wetherby, Yorkshire, England

## AVAILABILITY OF PUBLICATIONS ABSTRACTED

DOE reports are offered for sale by National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161. The availability of other reports, when known, is also indicated in the report number indexes.

For information on non-report documents such as journal articles, conference papers, books, and monographs the user should check the citation closely; it may be necessary to request from the originator or contact local, state, and university libraries or commercial reprint services. Theses are available from University Microfilms International, Dissertation Copies, P. O. Box 1764, Ann Arbor, MI; request by Order No., e.g., 82-0732.

Corporate Index
Author Index
Subject Index
Contract Number Index
Report Number Index

UNITED STATES DEPARTMENT OF ENERGY
P.O. BOX 62
OAK RIDGE, TENNESSEE 37830

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
UNITED STATES
DEPARTMENT OF ENERGY

FS- 1
UNIVERSITY MICROFILMS INTERNATIONAL
ATTN SERIALS PROCESSING
300 NORTH ZEEB ROAD
ANN ARBOR, MI 48106